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Hydroelectric Construction Sites Along Columbia River

Review of Tentative Plans for Some of Locations Made Under Direction of Oregon State Engineer—Power Proposed to Be for Fixation of Atmospheric Nitrogen — Views of Certain Rapids

By W. A. SCOTT

The potentiality of the Columbia river as a source of power has been demonstrated, tentatively, by investigations, surveys and studies, which are of record in both public documents and reports of private concerns. There are five natural power sites on that river between the mouth of the Willamette, near Portland, and the United States-Canadian boundary line. Beginning with the one farthest down stream, those sites may be named in the following order: Cascade Rapids at Bonneville, Ore., 45 mi. above the mouth of the Willamette, and 45 mi. from Portland; Five-Mile Rapids, near The Dalles, and 90 mi. east of Portland; Umatilla Rapids, 3 mi. upstream from Umatilla; Priest Rapids, approximately half way between Pasco and Wenatchee; and Kettle Falls, in the northeastern part of Washington. The sites at Bonneville, The Dalles and Umatilla concern the states of both Oregon and Washington, the river at those points forming the state boundary line. Those at Priest Rapids and Kettle Falls are wholly in the state of Washington.

The first three named were made the subjects of special investigations by the State of Oregon, under direction of John H. Lewis, former state engineer, between 1912 and 1916. But, previous to that period, a bulletin issued by the U. S. Geo-

Downstream View of Columbia River, Near The Dalles, Showing Upper End of Five-Mile Rapids.

logical Survey gave an outline of the Columbia river's drainage area and its characteristics, and presented data on the flow of the stream. It was shown that above the power sites of Bonneville and The Dalles the Columbia drains an area of approximately 250,000 sq. mi. Then, the data worked out by the state engineer's office had been supplemented by facts developed by the corps of engineers, United States Army, in connection with the construction of the government locks at Cascade Falls, above Bonneville, and the construction of the Celilo ship canal and locks above The Dalles. It may well be explained, relative to the latter location, that the "Dalles" in the river refers to what is otherwise known as Five-Mile Rapids. The army engineers, preliminary to the construction of canals and locks at the two locations, prepared topographic maps, which were available to the engineers of Oregon.

Reports Relative to Cascade Falls and Five-Mile Rapids.

The preliminary report on the power possibilities at Cascade Falls, near Bonneville, was prepared in 1916 by L. F. Harza, under direction of the state enginer of Oregon. This report outlined a plan of development in a merely tentative way, using available data, supplemented by inspection and such field surveys and river soundings as were deemed essential for a preliminary study. It shows that the river at this point is contracted from a width of 3000 to one of 500 ft. At the falls, proper, there is a fall of about 20 ft., and in the continuance of the channel a distance of 4 mi. over the Cascade rapids there is an additional fall of about 20 ft. Throughout that distance of 4 mi. or more the stream is confined to a narrow channel and flows at high velocity. At various stages of water it is figured that this site would afford a head of 36.7 ft. at low water, 42 ft. at usual flood stage, and 43 ft. at extreme stage. The plan of development outlined in a tentative way provides for the construction of a dam at a point below the falls, to be of sufficient height to absorb the rapids and falls above it, and for the excavation of a canal from there to the power house. This location of the dam would contemplate building it across the lower end of Bradford island, which divides the river channel. This would make a power canal of that part between the island and the Oregon shore. They would also contemplate making a closed dam across the latter channel, and extending a 2000-ft. spillway dam from there across the island and thence across the right channel to the Washington shore. It is figured that the power thus made available would be sufficient to operate a plant of 150,000-kw. capacity. The estimated cost of the project, exclusive of dam, at the date of the investigation, was $10,846,000.

Investigations and studies of Five-Mile Rapids were instituted by J. H. Lewis, Oregon state engineer, in 1912, who assigned the work to L. F. Harza and V. H. Reineking, civil and hydraulic engineers. A report by those engineers, submitted early in 1913, covers the subject of possible power development in all of its phases. It deals with the general feasibility of utilizing this site and includes preliminary plans of construction and cost estimates. It contains, also, an outline of industries that logically would be attracted to a locality where abundant and cheap power are produced.

The site of the proposed development is just above the city of The Dalles. The diversion point of the proposed power canal will be at the head of Five-Mile rapids, the proposed powerhouse site being at the lower end. Beginning at the head of the rapids, the stream for a distance of 9000 ft., at ordinary stage of water, is confined to a rock-bound channel 160 ft. in width. The banks, composed of solid basalt rock, rise to a height of 40 to 60 ft., and the bed is made up of a succession of pockets 40 to 60 ft. deep, creating a series of eddies and cross-currents. In that distance there is a fall of 11.2 ft. This narrow channel discharges into a whirlpool known as Big Eddy, from which the river makes a right-angled turn to the west.

The plan of power development proposed is to construct a dam, 300 ft. long and 180 ft. high, across the channel at the head of the rapids, and to excavate a power canal, 325 ft. wide and 8500 ft. long, on the Washington shore. This canal would run parallel to Five-Mile rapids, and would lead from a point above the dam to Big Eddy. The designated location of the power plant is over and across the canal where the latter discharges into Big Eddy. The general plant structure would include a spillway dam. The volume of water to be carried by the proposed canal is estimated at 50,000 to 145,000 sec. ft., as gaged by the variable stages of the river.

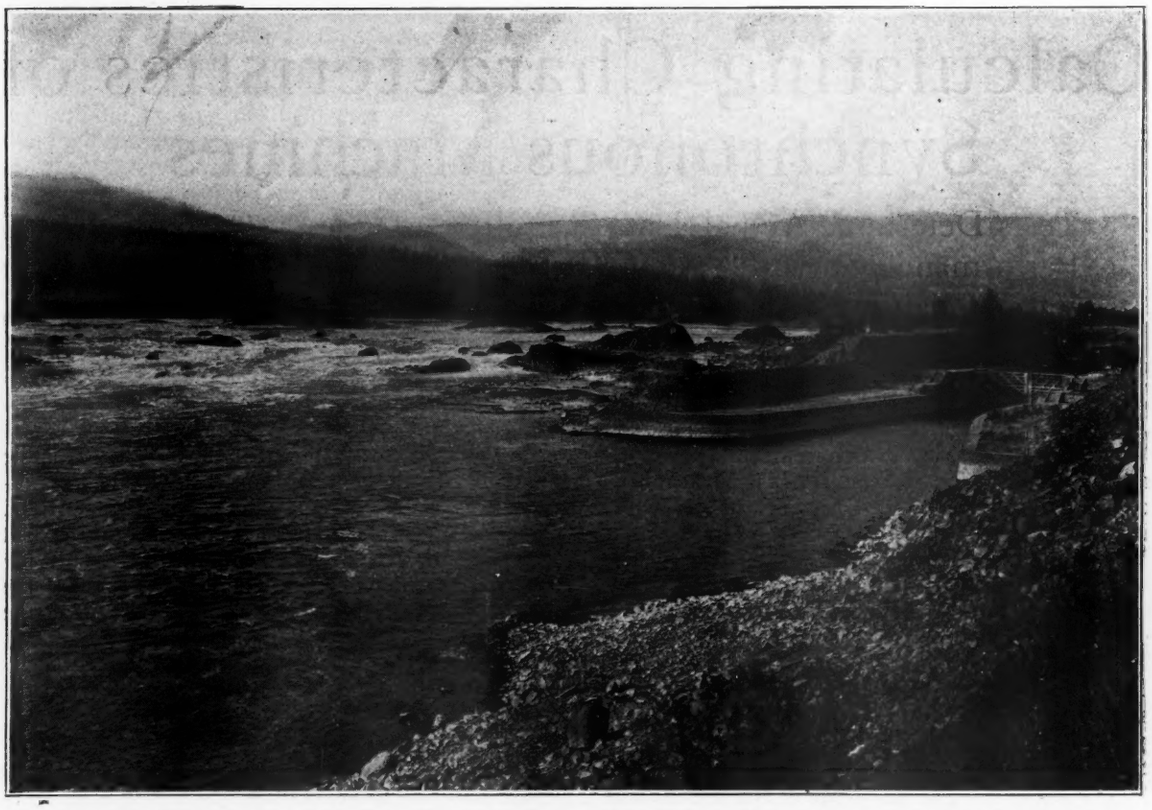
The proposed power-plant structure is designed to house hydraulic turbines, each of the maximum capacity of 32,000 hp., operating under a mean head of 70 ft., and driving a 20,000-kw. generator. The number of units proposed is sufficient to give the plant a capacity of 300,000 hp.

It may be explained that the Celilo ship canal and locks, completed by the Government 7 yrs. ago, by which river boats pass around Five-Mile Rapids, were built on the Oregon side.

One of the industries for which it is proposed to supply electric power at this point is that of a plant for the fixation of atmospheric nitrogen. A plant of that character, of the requisite capacity to supply a world market, would require 240,000 hp. of electrical energy.

Development to Aid Navigation and Provide for Power Production.

The construction of a dam has been proposed for Umatilla rapids for the two-fold purpose of drowning out the rapids which are troublesome to navigation, and as a means of developing hydro-electric power for use in pumping water to irrigate adjacent lands. The first investigations were made by the state engineer of Oregon, and data were subsequently prepared by Garfield Stubblefield, consulting engineer. Other investigations made by United States engineers developed the necessary facts relative to the bedrock formation at the proposed dam site. Additional useful information was brought out by H. A. Rands, civil and hydraulic engineer, in connection with a traffic survey which he made of the Columbia and Snake rivers, for the Port of Portland in 1918. His observations related to the advantages of a dam at Umatilla rapids as a means of securing cheap power for operating irrigation pumps,



Cascade Rapids, in Columbia River, Near Bonneville, Showing Lower End of Government Canal and Locks.

thereby increasing farm production and developing traffic.

It has been shown by the investigators that the bedrock at Umatilla site, extending from shore to shore, lies at depths ranging from 1 to 5 ft. below low water, making a most favorable dam site. The low-water width is about 4000 ft. It is estimated that a suitable foundation for a spillway section can be obtained by excavation to a depth of 5 to 10 ft. The proposed development contemplates the construction of a main dam with spillway 2000 ft. long having a 35-ft. crest elevation above low water, and an additional spillway 3000 ft. long with a crest elevation of 55 ft. above low water. The proposed equipment contemplates the installation of 32 hydroelectric units of 10,000 hp. each.

Efforts are being made to secure the co-operation of the states of Oregon and Washington and the U. S. Reclamation Service in handling this project.

Priest Rapids Suitable for Production of 350,000 Hp.

Development at this location is being undertaken by the Washington Irrigation & Development Co., which in recent years has expended $50,000 on engineering surveys, and in working up data on prospective dam construction for hydroelectric development. The possible potentiality indicated by those investigations is 350,000 hp. at ordinary stages of water. The proposed dam, as shown by preliminary plans, would be 7000 ft. in length, 90 ft. high, and would create a new storage basin 1.5 mi. wide and 9 mi. in length. The 12 mi. of rapids at this location makes a descent of 90 ft. The dam site selected is 14 mi. downstream from Beverly, which is the place where the C. M. & St. Paul railway crosses the Columbia. The cost of the proposed development is estimated at $30,000,000.

Preliminary investigations of power possibilities at Kettle Falls are being made by engineers of the Washington Water Power Co., of Spokane, but at this date no decision as to actual development there has been made.

ELECTRIC RAILWAY PLANNED FOR TEXAS.

Construction of the interurban electric railway that is to run from Dallas to Terrell, Tex., 30 mi., will be started soon, according to C. W. Hobson, vice-president of the Dallas Railway Co., which is to build the new line. Mr. Hobson said that the proposed road will cost approximately $1,800,000, or $60,000 a mile, to construct. Nearly all of the right-of-way has been obtained and orders for materials are being placed. The construction of this line is in compliance with the terms of the franchise under which the Dallas Railway Co. is operating its system of electric street railway. The General Electric Co. is in control of the property.

Among the exhibits at the exposition held recently at Essen under the auspices of the Electrotechnical Association of the Rhenisch-Westphalian Ruhr District was an electromagnetic process exhibited by Krupp for recovering coal and coke from the ash residue taken from hard-coal furnaces. It was claimed for the invention that if it had been applied to the 15,000,000 tons of ash waste of the German industries in 1913, 30% or approximately 5,000,000 tons of coal and coke might have been recovered.

Calculating Characteristics of Synchronous Machines

Tests Determine Actual Data Required to Compute Complete Performance Curves — Method to Be Employed in Calculating Various Values from Test Readings—Curves Computed from Trial

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The tests necessary to determine the performance characteristics of synchronous machines include measurement of the resistance of the windings, determination of the open-circuit, short-circuit and zero-power-factor saturation curves, measurement of core loss, short-circuit loss, friction and windage and temperature tests. In the case of synchronous motors tests for dead points, starting torque and pull-in torque are also made. To illustrate the method here described the results of the tests on a 225-kv-a., 50-deg. C., 80% power-factor, 240-volt, 60-cycle, 327-r.p.m., vertical revolving-field alternator are given.

Resistance of the windings.—The resistances of the windings are taken by the voltmeter-ammeter method while the machine is at room temperature. The values for the machine under consideration are given in the accompanying resistance table.

Open-circuit saturation, core loss and friction and windage.—The open-circuit saturation and core loss readings are taken at the same time. The machine under test is belted to a shunt-wound d-c. motor and is driven at rated speed. The field current of the synchronous machine is varied from zero value to that required for 135% of normal terminal voltage. With the speed constant readings are taken for each value of excitation of the field current, terminal voltage and speed of the driven machine, and of the field current, line current and armature voltage of the driving motor. For friction and windage a reading is taken of the field current, line current and line voltage of the driving motor with the belt removed and at the speed employed when driving the machine under test. The field current for the driving motor is kept constant throughout the test, and all speed regulation is obtained by means of adjustment of resistance in the armature circuit. The readings for this test are shown in the accompanying table No. 2.

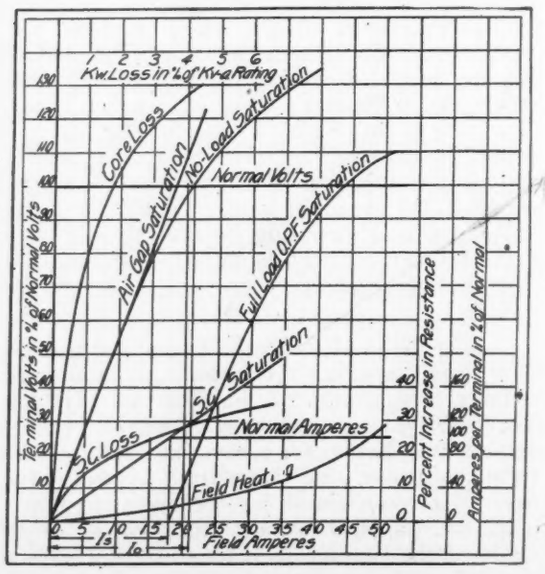


Fig. 1.—Chart Showing Saturation and Loss Curves of 225-Kv-A. Alternator.

Short-circuit saturation and short-circuit losses.—Just as in the open-circuit saturation and core loss test, the machine under test is driven by a shunt-wound d-c. motor at rated speed, with the armature terminals short-circuited through an ammeter the excitation of the synchronous machine is carried from zero to the value required for 150% of normal line current. With the speed constant, readings are taken for each value of excitation of the armature current and field current of the a-c. machine and of line current, field current and armature voltage of the driving motor. The readings for the machine under consideration are given in the accompanying table No. 2.

Zero-power-factor saturation.—The saturation at zero power-factor is obtained by paralleling the machine to be tested with an a-c. generator of the same capacity as the machine to be tested, or larger. The machine under test is then over excited until its rated full-load current is circulating between the two machines. By adjusting the excitation of both machines the terminal voltage may be varied, keeping the rated full-load current of the machine under test circulating in the two armatures. Readings are taken on line volts, line amperes and field amperes of the over-excited machine.

Temperature tests.—For the temperature test the machine to be tested is run as a synchronous motor and is over excited until rated full-load current is circulating in the armature winding at rated voltage. With thermometers placed on the armature winding and core at four or more places readings are taken every 0.5 hr. of line voltage, line amperes, field voltage, field amperes and temperatures of the machine and room. The test is continued until the temperature rise of the machine above the room temperature is constant. After the machine is shut down thermometers are applied to the field windings and readings are taken at frequent intervals of the temperature of all parts of the machine until maximum temperature is reached. The hot-armature resistance is

also taken after shut down. If the machine under test is a unity-power-factor synchronous motor it is not possible to over excite the motor to circulate full-load current in the armature winding without heating the field excessively, due to the high resistance of the field winding. The armature temperature for a machine of this type may be determined by driving the motor as a generator with the armature short-circuited and carrying full-load current. The readings for the temperature test on the machine under consideration are given in detail in the accompanying table No. 3.

Dead-point and starting-torque tests.—The center line of one pole of the motor to be tested is marked, and the space on the armature ring embraced by the center line of the marked pole and the center line of an adjacent pole is divided into a number of equal parts. The number of divisions should be equal to the number of slots per pole in the armature. The marked pole is then placed in line with each one of the division marks on the armature ring. With a brake arm applied to the shaft of the motor to prevent rotation readings are taken of the applied voltage, terminal amperes, watts input and pull in pounds at the end of the arm for each position of the rotor. The applied voltage is kept constant for each reading and of such value as to prevent excessive current from flowing in the armature winding. For the starting-torque readings the rotor is locked in the position of minimum torque, as determined from the brake-arm readings of the test explained above, and for different values of applied voltage readings are taken of armature current and watts input. In the above tests the motor field winding is short-circuited through a resistance to prevent the high induced voltage with open field winding from injuring the field-winding insulation, and also for the personal protection of the operators.

Pull-in torque.—The motor to be tested is run as an induction motor with the field winding short-circuited through a resistance and belted to a d-c. generator. For a certain applied voltage the maximum load is found that the motor will pull into synchronism when the field is excited. Readings are taken for different values of applied voltage, including normal voltage.

Calculating Machine Characteristics From Test Data.

In calculating the characteristics of the machine from the tests explained above it will be found convenient to work with percentages rather than with actual values; that is, with voltages expressed in percent of normal voltage, armature current in percent of full-load armature current and losses in percent of the full-load kv-a. rating. In the case of a synchronous motor the losses are expressed in percent of the full-load kilowatt output of the machine.

Resistances.—The resistances of the windings for the observed temperature are calculated by Ohms law. As the resistance losses are calculated for a temperature of 75 deg. C. for all loads (A. I. E. E. Standardization Rules, Sec. 432), it will be necessary to correct the resistances to this temperature. The resistance of a copper winding at any temperature may be found from the observed resistance at any other temperature from the following relation:

$$R_1 = (t_1 + 234.5)R_2/(t_2 + 234.5)$$

where R_1 equals the resistance at a temperature t_1 deg. C., and R_2 equals the resistance at a temperature t_2 deg. C.

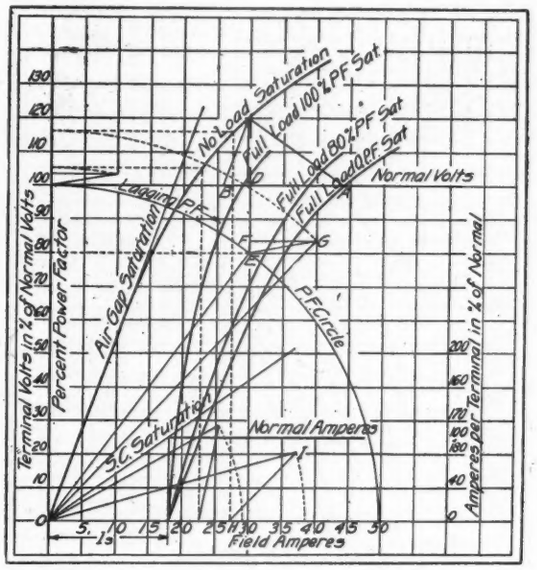


Fig. 2.—Chart Showing Graphic Method of Computing Data.

Saturation curves.—The open-circuit saturation curve shows the relation between field current and generated voltage at no-load. The curve for the machine under consideration is plotted in Fig. 1, with generated voltage in percent of normal voltage as ordinates and corresponding values of field current as abscissas. The zero-power-factor saturation shows the relation between generated voltage and field current for full-load armature current at zero power-factor. The short-circuit saturation curve shows the field current necessary to circulate different values of armature current in the short-circuited armature. This curve is shown in Fig. 1 with the armature current in percent of full-load current as ordinates and of field current as abscissas.

Losses.—The losses that are taken into account are armature I^2R, field I^2R, rheostat losses, core loss, stray-load losses and friction and windage losses. The losses are calculated for full load, three-fourths load, one-half load and one-fourth load. Armature I^2R losses are figured as follows:

$$\text{Armature } I^2R = I_s^2 \times R \times K$$

where I_s equals the equivalent single-phase current, which is equal to (Kv-A. $\times$ 10^3)/Volts, R equals the terminal-to-terminal resistance at a temperature of 75 deg. C., and K equals 0.5. This equation holds for 2-phase and 3-phase machines with any type of connection. The armature I^2R losses are given in an accompanying table for the different loads in percent of the normal kv-a. rating of the machine.

In the copper-loss table I_0 represents the field current necessary to generate normal voltage plus the armature-resistance drop in case of a generator and minus the armature-resistance drop in case of a motor. This field current is found from the open-circuit saturation curve. To the point

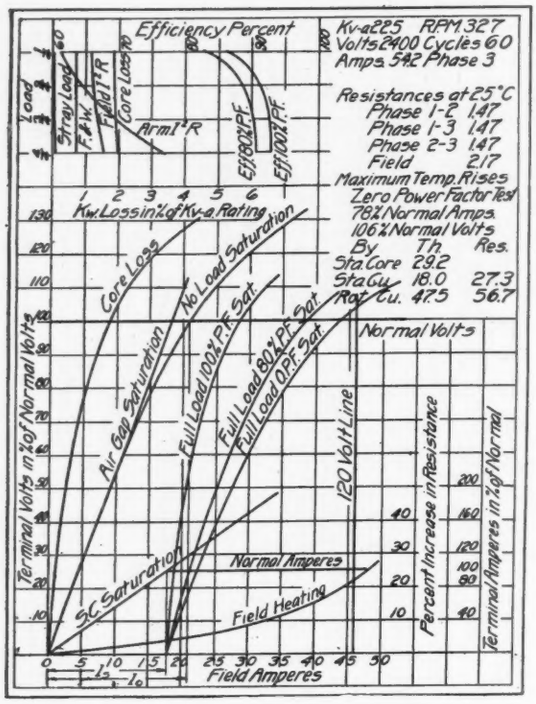


Fig. 3.—Chart Showing Saturation, Heating, Loss and Efficiency Curves of 225-Kv-A. Alternator.

of normal voltage, on the voltage axis, add—for a synchronous motor subtract—the armature-resistance drop, and from the no-load saturation curve read the corresponding value of field current. An accompanying table, No. 4, shows that for full load the armature I^2R loss in percent of rated kv-a. is equal to the armature-resistance drop in percent of rated voltage. Then, knowing the armature I^2R loss, the resistance drop for the different loads may be readily calculated. I_s represents the values of field current necessary to overcome the synchronous impedance for the different values of load current and is read directly from the short-circuit saturation curve. The square root of I_0 squared plus I_s squared for any given load gives the field current for that load at unity power-factor. The field current for 80% power-factor is found graphically as shown in Fig. 2.

From the point *A*, Fig. 2, on the zero-power-factor saturation curve, lay off *AB* on the normal-voltage line equal to I_s. From *B* draw a line parallel to the air-gap saturation until it intersects the no-load saturation curve at *C*. From *C* drop a perpendicular to the normal-voltage line to *D*. Then *CD* equals the reactance-voltage drop and *DA* equals the armature-demagnetizing effect in terms of field current. To vector *OE*, the terminal voltage at 80% power-factor, add—in case of a synchronous motor subtract—the armature-resistance drop in percent of normal voltage, equal to *EF*, parallel to the voltage axis. At the point *F* add the armature-reactance drop in percent of normal voltage, equal to *FG*, perpendicular to the voltage axis. The resultant generated voltage, from the no-load saturation curve, requires a field current equivalent to *OH*. To *OH* add the armature-demagnetizing effect *HI*, equal to *DA*, parallel to the generated voltage *OG*. Then *OI* represents the field current required to generate normal voltage at 80% power-factor. Fig. 2 shows the construction for full-load 80% and 100% power-factor. The field current for any other load may be found by using the resistance drop, reactance drop and armature-demagnetizing effect for the load under consideration. The field

TABLE NO. 1—RESISTANCE READINGS AT ROOM TEMPERATURE OF 20 DEG. C.

PHASE 1-2			PHASE 2-3			PHASE 1-3			FIELD		
Volts	Amperes	Resistance	Volts	Amperes	Resistance	Volts	Amperes	Resistance	Volts	Amperes	Resistance
5.6	4	1.40	5.6	4	1.40	5.6	4	1.40	31.3	15	2.09
11.7	8	1.46	11.7	8	1.46	11.7	8	1.46	44.8	20	2.24
21.8	15	1.45	21.8	15	1.45	21.7	15	1.45	51.5	25	2.06
Average		1.44			1.44			1.44			2.13

	20 deg. C.	25 deg. C.	75 deg. C.
Armature resistance in ohms ..	1.44	1.47	1.75
Field resistance in ohms	2.13	2.17	2.59

I^2R loss plus the rheostat losses are equal to the field current times the exciter voltage. The losses are given in the table of copper losses for 100% and 80% power-factor in percent of the kv-a. rating. For a synchronous motor these losses are expressed in percent of the rated kilowatt output of the machine.

The data for the open-circuit core loss for the machine under consideration is given in table No. 2 and has been taken as previously explained. The difference between the kilowatt input into the driving motor, with the alternator excited and with zero current in the field winding, is the kilowatt core loss. The core loss for different values of terminal voltage is plotted in Fig. 1, with the terminal voltage given in percent of normal voltage as ordinates and corresponding core loss in percent of normal kv-a. as abscissas. The core loss for the load under consideration is then taken from the core-loss curve and is equal to the core loss corresponding to normal voltage plus—in case of synchronous motor minus—the armature-resistance drop. The loss thus obtained includes a small armature-copper loss of the driving mo-

TABLE NO. 2—SATURATION LOSSES FOUND IN TEST OF 225-Kv-A. ALTERNATOR.

—MACHINE UNDER TEST—						—DRIVING MOTOR—				
R.P.M.	Line volts	% Normal volts	Line amperes	% Normal amperes	Field amperes	Field	Line volts	Line amperes	K.w. loss	Loss % Normal rating
327	1400	58.4	....	.....	11	2	346	24.7	1.37	0.61
327	1800	75.0	....	.....	14.5	2	346	28.4	2.64	1.17
327	2200	91.6	....	.....	18.5	2	342	30.2	3.14	1.40
327	2300	95.8	....	.....	19.6	2	343	32.0	3.80	1.69
327	2400	100.0	....	.....	21.0	2	343	33.2	4.17	1.85
327	2600	108.2	....	.....	24.0	2	341	35.6	5.02	2.23
327	2800	116.7	....	.....	27.8	2	340	40.5	6.60	2.93
327	3120	130.0	....	.....	30.2	2	340	50.0	9.80	4.35
327	0	0.0	....	.....	0.0	2	350	20.5	7.18	....
327	0	0.0	....	.....	0.0	2	350	20.5	7.18	....
						2	402	14.0	5.61	....
				Belt off		2	402	14.0	5.61	....
									1.57	0.70
327	....	.....	30.0	55.4	9.8	2	348	25.9	1.82	0.81
327	....	.....	45.0	83.0	15.0	2	341	34.4	4.54	2.02
327	....	.....	56.0	103.2	19.0	2	333	43.2	7.22	3.21
327	....	.....	68.0	126.0	23.2	2	321	59.5	11.92	5.30
327	2600	108.2	54.2	100.0	49.5	.	...	....	.....	....
327	2400	100.0	54.2	100.0	44.0	.	...	....	.....	....
327	2040	85.0	54.2	100.0	37.4	.	...	....	.....	....

tor. The true core loss can be found by deducting from this core loss the difference between the armature I^2R of the driving motor when the alter-

nator is excited and when no current is flowing in the field winding.

The short-circuit loss is the sum of the armature I^2R loss and the stray-load loss, and is obtained from the data given in table No. 2 by deducting from the driving motor input, when driving the machine under test with excitation, the driving motor input for no excitation on the machine under test. The short-circuit loss curve is shown in Fig. 1 and is plotted with values of armature current in percent of full-load current as ordinates and kilowatts loss given in percent of the kv-a. rating as abscissas. The stray-load losses consist of iron losses and eddy current losses in the copper due to fluxes varying with the load and are equal to the short-circuit losses minus the armature I^2R loss for the load in question. The stray-load losses determined in this way include a small driving-motor armature I^2R loss which can be eliminated when necessary as explained under the discussion of open-circuit core losses.

Friction and windage losses are equal to the driving-motor input when driving the machine under test at normal speed without excitation minus the input into the driving motor when running alone at the same speed and with the belt off. This loss also includes a small armature I^2R loss in the driving motor which can be eliminated as given above. The correction for the armature I^2R loss of the driving motor is very small and in most cases may be neglected entirely.

TABLE NO. 3—SHOWING RESULTS OF TEMPERATURE TEST ON 225-Kv-A. ALTERNATOR.

Time	11:00	12:00	12:30	1:00	1:30	2:00	2:30	3:00	*
Line volts...	2530	2510	2510	2525	2530	2530	2530	2530	....
Line amperes	54	44	43.5	42.2	42	42	42	42	....
Field volts...	120	120	120	120	120	120	120	120	....
Field amperes	47	46.8	46.8	46.8	46.8	46	46	46	....
Room temp., deg. C.	....	21.2	20.5	21	21.5	21.5	21.5	21.5	....
Therm. Read, deg. C.:									
Stator core, 1	41.8	45.0	47.0	47.0	47.1	47.1	47.1	47.5	
Stator core, 2	42.0	45.5	47.5	47.5	47.6	47.6	47.6	47.8	
Stator core, 3	42.0	45.0	48.0	48.5	48.6	48.6	48.6	48.9	
Stator core, 4	44.0	47.0	50.0	50.0	50.1	50.2	50.2	50.7	
Stator copper, 1	....	35	36.5	37	37.1	37.2	37.2	37.2	37.9
Stator copper, 2	....	36.1	37.0	37	37.0	37.1	37.1	37.1	38.1
Stator copper, 3	....	36	37.2	37.3	37.3	37.3	37.3	37.3	38.5
Stator copper, 4	....	36.5	37.4	37.5	37.5	37.7	37.7	37.7	39.5
Rotor copper, 1	....	....	....	....	....	....	....	....	65
Rotor copper, 2	....	....	....	....	....	....	....	....	66
Rotor copper, 3	....	....	....	....	....	....	....	....	69
Rotor copper, 4	....	....	....	....	....	....	....	....	66

Temperature rise in deg. C.	By thermometer.	By resistance.
Armature core	29.2	....
Armature copper	18.0	27.3
Field copper	47.5	56.7

*Maximum temperature after shutdown.

Efficiencies.—The efficiencies are calculated by the separate-loss method; that is, the separate losses are calculated as shown above and added to the given output to obtain the input, and the efficiency is found as follows:

$$\text{Percent efficiency} = \frac{100 \times \text{percent output}}{\text{percent output} + \text{percent losses}}$$

The percent output for a generator at full load and unity power-factor is equal to 100%, and at any other power-factor is equal to 100 times the power-factor. The losses for 80% power-factor are the same as the losses for 100% power-factor with the exception of the field-copper losses and rheostat losses. The method of determining these losses has been previously explained. The losses and efficiencies for the machine under consideration are given in the accompanying tables for 100% and 80% power-factor.

TABLE NO. 4—COPPER LOSSES FOR A 225-Kv-A. ALTERNATOR, EXPRESSED IN PERCENT.

Load,	Armature. I^2R	IR	I_o	I_s	$I_o^2+I_s^2$	I_f	Field I^2R 100% P.F.	Field I^2R 80% P.F.
4/4	3.41	3.41	22.2	18.0	816	28.6	1.52	2.06
3/4	1.92	2.56	21.7	13.5	652	25.6	1.36	1.90
2/4	0.86	1.71	21.5	9.0	543	23.3	1.24	1.60
1/4	0.22	0.85	21.2	4.5	470	21.7	1.16	1.33

Temperature test.—The ideal method of making the temperature test is to load the machine under the same conditions as those under which it is to operate. This necessitates the expenditure of large amounts of power, usually for several hours—an item of considerable expense. Also a considerable quantity of equipment is required which may not be available. For these reasons a compromise test is usually made, the one outlined above being the one most generally used. The temperature of the armature core and copper under the conditions of this test are practically the same as under normal conditions of operations, while the field-copper temperature is somewhat higher. The temperature rise of the copper windings over a room temperature of 25 deg. C. may be found from the resistances by the following formula:

$$\frac{(\text{Hot resistance} - \text{Cold resistance}) \times 263}{\text{Cold resistance}} = \text{Rise in deg. C.}$$

where all resistances hot and cold must be corrected to a room temperature of 25 deg. C., and the constant 263 equals the reciprocal of the temperature coefficient of copper at 25 deg. C.

The percent increase in field resistance, or the constant by which the resistance at 25 deg. C. must be multiplied to give the resistance for the corresponding temperature rise, may be plotted to field amperes as shown in Fig. 1 giving the field heating curve. With this curve and the formula given above the field heating can be found for different values of field current.

Regulation.—If an alternator operating under load and at normal voltage has its load removed without changing the field current and speed the voltage will rise to a definite value depending upon the saturation of the machine. This increase in voltage, expressed in percent of normal voltage, is the regulation for the particular load. In order to determine the regulation for any given load and power-factor the field current for that load and power-factor must be known. The field current for any load and power-factor is determined as previously explained. The open-circuit voltage corresponding to this field current is then read from the no-load saturation curve. The difference between this open-circuit voltage and normal voltage, expressed in percent of normal voltage, is the regulation. The regulation may be read directly from the no-load saturation curve when it is plotted with voltage expressed in percent of normal voltage, as is shown in Fig. 2.

A form of final test sheet is shown in Fig. 3,

which give the characteristics for the generator under consideration.

Starting torque.—During the starting period a synchronous motor operates as an induction motor. The armature is the primary element and the squirrel-cage winding in the pole faces is the secondary element. When power is supplied to the primary a certain amount of this power is transmitted to the secondary through the magnetic field. The magnetic field is revolving at synchronous speed and produces a certain torque on the rotor—this torque times the speed at which the magnetic field rotates is the power delivered to the secondary. When the rotor is locked there is no output, and all the power put into the secondary is converted into heat. However, the field still exerts a torque upon the rotor and it is this torque that must be determined.

TABULATION OF EFFICIENCIES AND LOSSES AT 100% POWER-FACTOR.

Load	4/4	3/4	2/4	1/4
Armature I^2R	3.41	1.92	0.86	0.22
Stray-load loss	0.10	0.09	0.08	0.07
Field I^2R	1.52	1.36	1.24	1.16
Core loss	1.95	1.92	1.87	1.82
Friction and windage	0.70	.70	.70	.70
Total losses	7.68	5.99	4.75	3.97
Output	100.00	75.00	50.00	25.00
Input	107.68	80.99	54.75	28.97
Efficiencies	93.00	92.70	91.30	86.40

TABULATION OF EFFICIENCIES AND LOSSES AT 80% POWER-FACTOR.

Load	4/4	3/4	2/4	1/4
Armature I^2R	3.41	1.92	0.86	0.22
Stray-load loss	0.10	0.09	0.08	0.07
Field I^2R	2.06	1.90	1.60	1.33
Core loss	1.95	1.92	1.87	1.82
Friction and windage	0.70	0.70	0.70	0.70
Total losses	8.22	6.53	5.11	4.14
Output	80.00	60.00	40.00	20.00
Input	88.22	66.53	45.11	24.14
Efficiencies	90.70	90.20	88.80	82.90

The secondary input is equal to the product of the speed of the magnetic field and the torque exerted by it upon the rotor, but the speed of the magnetic field is constant; that is, synchronous speed, therefore the secondary input is always proportional to the torque. This torque is obtained by finding the power that is put into the secondary and then dividing that power by the synchronous speed.

The kilowatts input and the terminal amperes corresponding to the voltage which is to be applied to the motor in starting are obtained from the locked saturation test. The armature I^2R loss plus the core loss for that voltage are subtracted from the total kilowatt input, giving the kilowatt input into the secondary. The starting torque in percent of full-load torque is then found from the following equation:

$$\text{Percent starting torque} = \frac{\text{Kw.} \times 100}{0.746 \times \text{Hp.}}$$

where Kw. is the kilowatts input into the secondary and Hp. equals the horsepower rating of motor.

Pull-in torque.—The pull-in torque is a measure of the load that the motor will pull into synchronism when its field is excited. The readings required are taken as previously explained. The actual output of the motor is then found by adding the d-c. generator output and the generator losses. The pull-in torque is usually expressed in percent of the rated full-load torque of the motor and is found from the accompanying formula:

$$\text{Percent pull-in torque} = \frac{\text{Kw.} \times \text{synchronous speed}}{\text{Hp.} \times 0.746 \times \text{R.p.m. (before pull-in)}}$$

SOME FACTS REGARDING MICA FOR COMMUTATOR INSULATION.

Things to Do and Not to Do in the Making or Repairing of a Motor Commutator, According to Authoritative Suggestions.

A fine-toothed band saw with moderate set is recommended as best for cutting mica segments for commutator insulation. Otherwise the edges are liable to be torn, increasing the chances of causing a short-circuit when the commutator is turned up, according to suggestions made by the Western Insulation Co., Chicago. Mica segment plate contains a minimum amount of binder, but there is a sufficient quantity to adhere to the copper bar when the commutator is baked and tightened up. After assembling the copper bars and mica segments the unit should be baked long enough to bring every part to a temperature of 350 to 400 deg. F. before turning the V part, then tighten the commutator gradually as it cools, making it solid when nearly cold.

Types of Insulating Rings Made for Use in Commutators.

After turning the V's for the end rings, carefully examine all surfaces and scrape clear any places where the lathe tool has dragged the copper. Before placing the mica rings carefully remove all dust from both the commutator and rings. Short-circuits are sometimes caused by overlooking these details.

After the commutator is assembled on the shell with the rings in place it should receive a second baking at a temperature of about 300 deg. F. This baking is for the purpose of embedding the ends of the segments and setting the cement in the rings. It is essential that the commutator is not screwed up too tight before this baking, again bearing in mind the expansion of the copper. The best results are obtained by tightening up the commutator after baking as it cools, giving a final tightening when nearly cold. With a small commutator care should be taken not to exert such a pressure on the clamp ring that would cause it to dish and change its angle. A pressure of about 1500 lbs. per sq. in. on the inside taper ring gives good results.

Magnetic Pulleys Protect Rock-Crushing Plant

Tramp Iron Removed Effectively and Economically by Means of Magnetized Pulleys at End of Conveyor Belt—Motor-Generator Set Used for Excitation of Pulleys Where Conditions Require

By C. H. FOBIAN

Continuous production in a rock crushing plant is possible only when dependable means are used to eliminate stray pieces of iron from the rock before it is passed into the crusher. In some plants it has been the practice to attempt to remove this iron by hand from a slowly moving picking belt, which feeds the crushers. This entails a considerable amount of labor and does not by any means insure positive protection. In most up-to-date plants positive protection is obtained by the installation of one or more magnetic pulleys as head pulleys of the belt conveyors feeding the crushers. These magnetic pulleys are made in all standard sizes and can be easily installed in place of the ordinary cast iron head pulley of a belt conveyor. The magnetic pulley is furnished complete with shaft and this can be made to suit individual specifications so that the magnetic pulley will fit the old bearings and supports.

Where no belt conveyor is used for handling the rock, a small magnetic pulley separator can be used to advantage. This separator consists of a short belt conveyor having a magnetic pulley as head pulley. It is a self-contained unit and is mounted on a steel channel frame as is shown in Fig. 5.

Magnetic pulleys consist of a series of magnet coils and poles mounted on a steel shaft. The magnet coils are energized by direct current and where this is not available a small belt-driven d-c. generator or an a-c.-d-c. motor-generator set must be supplied. As shown by Fig. 2, the operation of a magnetic pulley is extremely simple. The magnetic pulley is used as the head or driving pulley of a belt conveyor. The material is discharged downwardly as it passes over the magnetic pulley while any iron contained therein is attracted by the powerful magnetic pull and held firmly against the surface of the conveyor belt until it is discharged underneath the pulley as the

Fig. 1.—Plant of Blue Diamond Plaster Co., Temescal Canyon, New Corona, Cal., Protected by Magnetic Pulleys.

belt leaves the pulley surface. No breaking of contacts or scraper is necessary to effect this discharge, the iron being carried gradually out of the magnetic field.

Magnetic pulleys have been manufactured in this country for nearly 20 yrs., and during the past 5 yrs. the use of this equipment has increased very rapidly until today magnetic pulleys are recognized as a necessity wherever pulverizers or crushers are used. To satisfy this increasing demand for magnetic pulleys, the Magnetic Manufacturing Co., Milwaukee, developed and perfected a "high duty" magnetic pulley which, although unique in its particular field, is nevertheless designed and constructed on principles that are nearly as old as the electric motor.

This pulley is so constructed as to proportions of copper and steel used that a tremendous increase in efficiency was obtained. The old type pulley was an inclosed type. The new type "high duty" pulley is ventilated and the two pulleys may be properly compared to the open and inclosed type electric motor. It is a well known fact that for a given horsepower a larger frame is required in the inclosed type motor than in the open type. The same is true of magnetic pulleys. To obtain a given magnetic pull a larger diameter pulley is required in the inclosed type than in the ventilated type.

Delays and interrupted production are very expensive and the selection of a magnetic pulley should receive careful consideration. In making this selection there are three points to be considered, viz: Magnetic efficiency, mechanical construction, electrical construction.

The one practical method for determining the relative efficiency of different sizes and types of magnetic pulleys is comparison of the pull in pounds exerted upon a uniform size iron test bar by the magnetic pulley through a uniform distance.

The table will give an idea of the relative efficiency of old type magnetic pulleys and "high duty" magnetic pulleys. The table gives the pull in lbs. per sq. in. of various magnetic pulleys through a 4-ply conveyor belt.

Diameter pulley, in.	PULL IN POUNDS Old type, pounds.	"High duty," pounds
12	8 to 10	17 to 19
15	12 to 15	26 to 30
18	22	38 to 40
24	40	60 to 65
30	43	70
36	45	75

As shown above, "high duty" magnetic pulleys are from 50 to 100% stronger than the old type of magnetic pulley. In that the capacity of a magnetic pulley depends upon its magnetic strength a greater capacity is obtainable on "high duty" magnetic pulleys.

The mechanical construction of these pulleys is such that they will stand up under the most severe service. Instead of having individual coil sections fastened together with through bolts, the magnetic circuit in "high duty" magnetic pulleys consists of a single dynamo steel casting, this providing a uniform magnetic circuit and eliminating all through bolts.

The magnet coils are wound with heat resisting

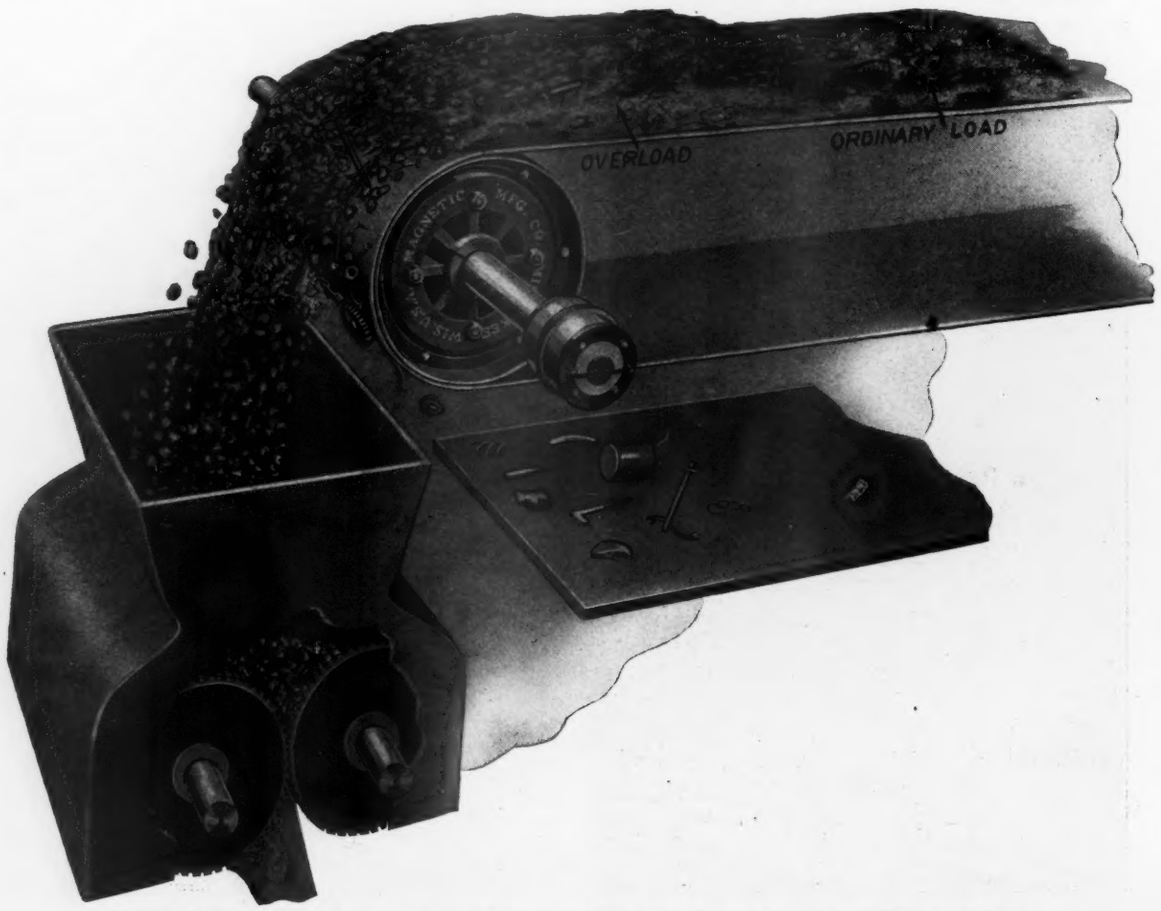


Fig. 2.—"High Duty" Pulley as Actually Seen in Operation, Removing Various Pieces of Iron.

magnet wire and the insulation consists of mica and baked enamel. In addition these pulleys are ventilated and so constructed as to obtain 2½ times the radiating surface obtainable in the inclosed pulley.

The capacity of magnetic pulleys varies with the diameter of the pulley, the width of the conveyor belt and the speed of the conveyor belt. It is important that a magnetic pulley of sufficient capacity be selected since if this is not done, there

CAPACITIES OF "HIGH DUTY" MAGNETIC HEAD PULLEYS IN TONS PER HOUR

Size pulley. Diam., in.	Face, in.	Capacity in tons.	Maximum belt speed recommended Feet per minute.
12	18	26	150
12	24	36	150
15	18	36	175
15	24	50	175
18	24	71	200
18	30	91	200
18	36	110	200
24	24	130	225
24	30	165	225
24	36	200	225
24	48	270	225
30	24	160	250
30	30	205	250
30	36	250	250
30	48	340	250
36	24	195	275
36	30	240	275
36	36	300	275
36	48	405	275

is a possibility of a large piece of iron passing the magnetic pulley undetected and shutting down a plant when continuous production is urgently required.

The following table gives conservative capacities of some standard sizes of "high duty" magnetic pulleys. Whenever possible the speed of the belt conveyor should not exceed the recommended belt speed given in the table.

These magnetic pulleys are being used in a great many plants and industries for the protection of crushers.

A typical installation and one which is of interest for a number of reasons was recently made at the crushed rock plant of the Blue Diamond Plaster Co., in Temescal canyon, New Corona, Cal. This company is the largest distributor of

Fig. 3.—Showing Amount and Kind of Iron Removed from Rock.

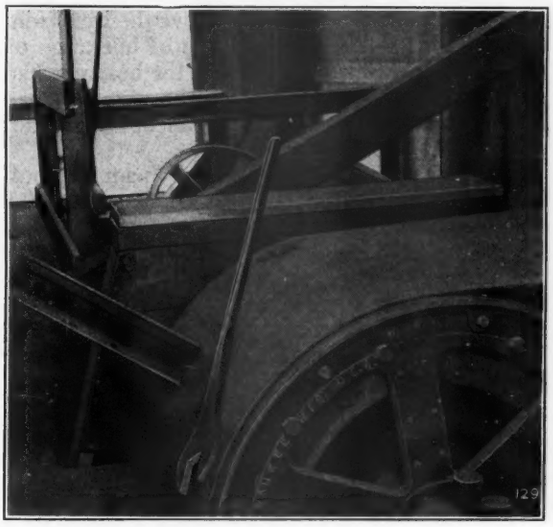


Fig. 4.—Illustrating Strength of "High Duty" Pulley.

building material in California. In addition to the plant near Corona, it operates four plants: The White Star Plaster Mill, Arrowhead, Nev.; lime plant, Tehachapi, Cal.; hydrated lime plant, Los Angeles; and the mortar and mixing plant, sand pit and bunker, Los Angeles. W. C. Hay is president of the company and is a firm believer in the efficacy of the magnetic pulley.

The plant at Corona is the largest on the Pacific Coast. The capacity is 1500 tons per 8-hour day, the material being a very hard porphyry. The rock is brought down by means of tunnel blasting. On March 12 a 40-ton dynamite blast was set off bringing down 500,000 tons of rock.

The rock is handled on the quarry floor by a 135-ton Marion steam shovel which is served by electric cars. It then passes through a 66 by 84-in. Superior jaw crusher and a No. 9 McCully gyratory crusher. The rock then passes over a 30-in. belt conveyor, 60 ft. long. The head pulley of this 30-in. belt conveyor is a 36 by 30-in. "high

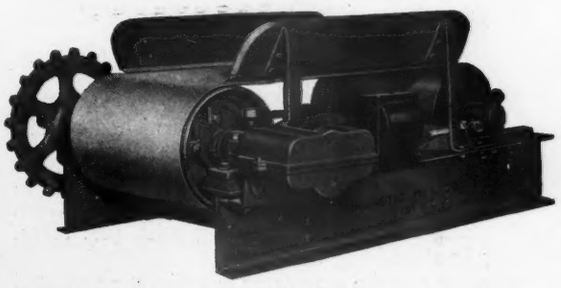


Fig. 5.—Self-contained Unit Mounted on Steel Channel Frame.

duty" magnetic pulley which removes all iron from the rock.

From this conveyor the rock passes over two 60-in. by 16-ft. scalping screens to a battery of four Symons disk crushers, three of which are 48-in. and one of 34-in. size. It was to protect these disk crushers that the magnetic head pulley was installed.

Before the "high duty" pulley was installed it was necessary to take up the disk crusher bearings once a week and the plant was frequently shut down because the disks were damaged by

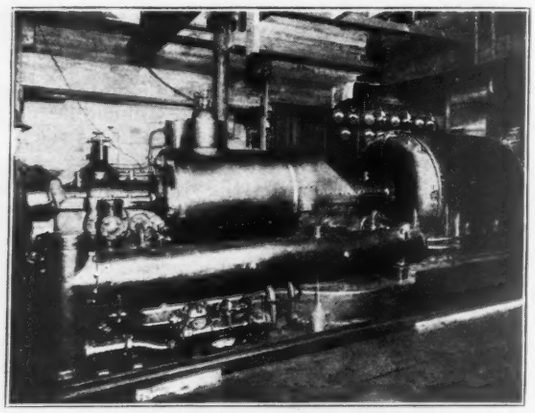
the passage of tramp iron. At this plant there were two men attempting to remove the iron from the conveyor belt. In one month of operation of the "high duty" magnetic pulley, the bearings had not been taken up, the cost of the two men had been eliminated and the plant had not been shut down because of disk trouble.

Fig. 4 shows the "high duty" magnetic pulley installed and its strength. Fig. 3 shows the amount and kind of iron removed from the rock by the magnetic pulley. In this pile are heavy chain lengths, sledge hammer heads, springs, nuts, track spikes, iron plates, rods, bolts, tin cans and nails. It is easy to realize the damage that would be done were this material passed into the disk crusher with the rock.

ELECTRICAL EQUIPMENT UTILIZED IN SAW MILL.

Large and Small Motors Find Ready Application in Various Parts of Plant—Steam Turbine Used to Generate Energy.

The Allis-Chalmers 800-kw., 480-volt, 60-cycle, 3-phase turbogenerator illustrated herewith is in service at the plant of Bloedel-Donovan Lumber Mills, Bellingham, Wash. This unit supplies power for driving 71 motors ranging in capacity from 3 to 225 hp. Nearly two-thirds of the



Turbogenerator Installed to Supply Energy for Light and Power in Lumber Mill.

power in the plant, however, is furnished by six steam engines of the combined capacity of about 1800 hp. Steam drive is applied to one 10-ft. band saw, two edgers, several sets of live rolls, 10 or 12 planers in the planing mill, one sizer, the log haul and log carriages.

Accessory to the generator is a direct-connected 15-kw., 125-volt, 83-ampere excitation generator, and there is installed in the generator room a 35-kw., 125-volt, d-c. generator, driven by a steam turbine, required for night lighting when the main unit is shut down. The day-time lighting is furnished from 110-220-volt, a-c., 3-wire circuits, through a bank of two 20-kw., single-phase transformers. The two outside wires of the 3-wire circuit for night lighting are of the same polarity, the center wire being of the opposite polarity. This connection is made by means of a 3-pole, double-throw, 300-ampere, 250-volt knife switch on the lighting panel of the main switchboard. The 35-kw. exciter is controlled from the exciter panel of the switchboard. The four feeder lines extending to distributing boxes in various parts of the mill are controlled by four General Electric oil circuit-breakers on the feeder panels of the main switchboard. In this distribution system Economy refillable fuses are used throughout.

Motor Rated at 225-Hp. Belted to Head Saw.

The heaviest electric drive in the mill is on a 9-ft. head saw for which an Allis-Chalmers 225-hp. motor is belted to the pulley of the saw. Other motor-driven machines consist of the automatic trimmers, gangsaws, slashers, feed rolls, chain carriers for the grading tables, resaws, swing cut-off saws, pony edger, hog machines and pumps. The resaws are direct-connected to their driving motors, but for most of the other machines belt transmission has been adopted.

While the edgers are steam driven the feed rolls for those machines are motor operated. Each set of feed rolls is driven by a 12-hp. constant-torque, multispeed motor equipped for four speeds. These motors have two separate windings controlled for the various speeds by means of a General Electric T-54 drum controller.

The machines in the lath mill are driven by belts from a line shaft, the latter being run by a 175-hp. motor through belt transmission. Another group drive is provided where a 75-hp. motor is belted to a line shaft from which a hog machine and a pony edger are driven. In a similar manner the same motor drives a 16-in. belt conveyor 30 ft. long with live rolls and carriers. A second hog machine is driven by a 100-hp. motor through belt transmission.

The barometric condenser for the steam turbine of the turbogenerator set is supplied with salt water by a Worthington centrifugal pump which is direct-connected to a 25-hp. motor. Three other centrifugal pumps, belt-connected to 40 and 50-hp. motors, supply sea water for a flume by which some of the refuse is carried to a waste dump. Two electric tram cars for carrying stock to the cargo dock are supplied with d-c. energy by a 550-volt motor-generator set installed in the main turbine room.

In this mill the log carriage is equipped with a 7.5-hp. motor which is connected by a gear and pinion to a Sumner set works by which the log is placed on the carriage in the exact position required for a specified cut by the saw. The energy for this motor is derived from a 440-volt, 3-phase overhead trolley line 110 ft. long supported by hangers from trusses above. This system, devised here, has been adopted at other mills and has resulted in lowered maintenance costs and has greatly limited the likelihood of breakdowns, according to Earle M. Dennis, chief electrician.

General Electric and Allis-Chalmers motors are used in the plant. Motors of 5 hp. and less are controlled by F.P.-10 oil circuit-breakers, and General Electric type I form K starting compensators are used for those above 5 hp.

George Woods, turbo operator with the Merchants Heat & Light Co., Indianapolis, is learning to drive a machine. George says he now has it tamed to the point where he only needs two-thirds of the street in which to drive.—*The Flash.*

Electric Shovels in Construction of Power Canal

Advantages Credited to Motor Operated Shovels Include Large Capacity, Speed of Operation, Reduced Labor Charges, Continuity of Operation and Reliability—Good Records Now Established

There is no question but that the rapid progress made in the construction of the Queenston-Chippewa power canal is due in a large measure to the huge electric shovels which are removing earth and rock on a daily average of 20,000 cu. yds. The labor force necessary to carry on this work is so small, comparatively, that it constitutes a record never before known in the construction world.

This power canal is an immense undertaking, as the accompanying illustrations show, and is now well under construction by the Hydroelectric Power Commission of Ontario, Canada. It will utilize at the highest possible efficiency the water power still available for Canadian use at Niagara Falls. The cost of this development, which will give 300,000 hp. to Ontario, is estimated at $25,000,000. The canal, the diagram of the course of which is shown in an accompanying map, will extend 13.5 mi. from Chippewa at the mouth of the Welland river, above Niagara Falls, to Queenston on the banks of the Niagara river. The Welland river will be used for 4.5 mi. of the canal, the remaining 9 mi. being excavated. The river will require the excavating of approximately 400,000 cu. yds., the total excavation necessary in the canal being about 10,000,000 cu. yds. The first 1.5 mi. of the canal just beyond the river is earth excavation, while the remainder is rock with the exception of a short section opposite the whirlpool in the Niagara river.

Engineers for the Hydroelectric Power Commission spent several months collecting and studying data in connection with the operation of electric and steam excavating machinery, and after various types were witnessed in both the United States and Canada electric shovels were decided to be the best from the standpoint of output, operating cost, working conditions and other important items.

Of the 10 Bucyrus electric shovels used most of the excavation is being done by three revolving type *225-B*, and three *103-C* shovels of the railroad type. The *225-B* shovels, one of which is shown in an accompanying illustration, are the largest ever built, each weighing over 330 tons. They have a 90-ft. boom, set at an angle of 35 deg., and a 58-ft. dipper handle. Dippers of 5 to 8-yd. capacity are used, depending on the nature of the excavation. All of the Bucyrus shovels are equipped with Westinghouse electric

View Showing Work of a 225-B Shovel in Cutting Through Niagara Limestone.

Airplane View of Canal, Showing Work in Progress.

motors and control, the largest using four 400-volt, 3-phase, 25-cycle motors as follows: Two 250-hp. motors for the hoist, one 150-hp. motor for thrust, and one 150-hp. motor for swing. The controllers are of the master-switch magnetic type.

The output of these large shovels is worthy of note. Some of the records obtained for one 10-hr. shift are as follows: A total of 4930 cu. yds. by a *225-B* shovel loading on two tracks, one on each side, with separate train services; 4770 cu. yds. by a *225-B* shovel loading on only one track. For two 10-hr. shifts covering 26 days a monthly record of 175,800 cu. yds. was obtained. One of the shovels shown in an accompanying illustration digs 8 cu. yds. with every load of the dipper, raises this to the dump cars 70 ft. above and returns for a new load every 50 sec. At some places on the canal the shovels have operated against a face 90 ft. high and have loaded into cars on tracks 72 ft. above their own base. Moreover, earth is not the only material which these shovels handle, for as can be noted from the illustrations rock also is excavated with equal ease.

Regenerative Braking Saves Some Power and Reduces Brake Wear.

One striking example of the many advantages of electric shovels is the use of regenerative braking. This is accomplished when the dipper or bucket is ready to be lowered, in which case the motors are disconnected from the power supply. The dipper then falls with the motors running at slightly above synchronous speed. When such a condition is reached the power switches are closed, thus making the motors operate as induction generators. Although, as can be readily appreciated, some energy is generated and delivered back into the line, the main feature of the operation lies in the fact that the brakes are unnecessary except for stopping or holding the boom in a certain position. Therefore the cost of maintenance of the brakes is exceedingly low, and since they are not used continuously greater reliability is obtained.

The principal advantage of electric shovels over steam shovels are given as follows: The electric shovel eliminates the various problems of fuel supply. To a great extent the capacity of the shovel is limited by the number of cars that can be supplied for the shovel to load and subsequently removed when loaded. If the tracks are encumbered with cars carrying coal to the shovel the number of cars to be loaded must necessarily be reduced. Further, cars carrying fuel to the shovel can seldom be unloaded directly on the firing floor, and the fuel is usually dumped on the ground and subsequently pitched onto the firing floor. This involves a repeated handling of the material with consequent wastage and the use of additional labor. Where the shovel is working on a narrow ledge or in some other inaccessible position the elimination of the necessity of supplying it with fuel is a matter of very decided importance.

Steam shovels require a continuous supply of water for the boilers. Not only is the matter of getting the water to the shovel often a difficult task, but the quality of the water supply often introduces difficulties resulting in the scaling and burning out of the boiler tubes. Water carrying a great percentage of impurities, such as is often the only kind available in mining regions, may necessitate the installing of a water-treating plant. Cold weather is apt to cause interruptions in shovel operations, due to the freezing of water pipes, and at times the necessity for cleaning boiler tubes may cause protracted shutdowns.

The electric shovel consumes power only while it is operating; it has no stand-by losses. The steam shovel, on the other hand, consumes fuel even when not operating as it is not feasible to draw the fires under the boiler for short shutdowns, and in cold weather fires must be maintained at all times in order to prevent freezing. The labor required for operating electric shovels is only a part of that required with an equivalent steam shovel. Both types of shovels require the same number of shovel operators, which may

Close-Up View of Electric Shovel About to Deposit 5-cu-yd. Load.

be either one or two according to the size and design. It is believed that there has never been a large one-man steam shovel, while most of the large electric shovels are successfully operated by one man. The steam shovel in addition requires a combined engineer and fireman whose use is entirely eliminated in the case of an electric shovel.

The steam shovel always necessitates the employment of one or two men for delivering the coal onto the firing floor of the shovel, but this is unnecessary with an electric shovel. When motor-operated jacks are used on electric shovels the roustabout gang which is always in attendance on the shovel for removing tracks, eliminating obstructions, etc., can usually be reduced by one or two men. In this way the total labor charges against the electric shovel will be found to be approximately 70% of that for the steam shovel of equivalent capacity.

Electric Shovels Particularly Suitable for Use in Cities.

In contracting work in cities there is no smoke nor sparks, and no objectionable noises attendant upon the operation of the electric shovel, as compared with the steam shovel. In addition, the

Map of Canal and Various Other Features of Surrounding Territory.

electrically operated shovel gains time over the steam-operated shovel, due to the elimination of delays encountered with steam equipment. These delays are those incident to supplying the boiler with fuel, clearing trouble on the water line and the more protracted shut-downs required by boiler repairs. Actual records of the operation of electric shovels show that their time out of service is considerably less than that of steam shovels under the same conditions of work. Therefore, the tonnage that can be handled on a given shift of the electric shovel gains over the

View Through a Rock Section Being Excavated by Electric Shovel.

steam shovel at the start of each shift and frequently also after the noon hour, due to the fact that to start the electric shovel there is only required the closing of the main line switch, whereas in starting the steam shovel fires must be cleaned and the steam pressure brought up. Experience in Chile as to breakdowns on electric shovels show approximately one-third the same delays from all sources as encountered with steam shovels.

The application of electric equipment to excavating shovels has proved, beyond question, a complete success from every standpoint. The electric shovel is an evolution of the steam shovel which has been redesigned in order to take full advantage of the characteristics of the electric equipment.

CONTROL BOARD FOR SOUTH MEADOW GENERATING STATION.

Equipment Set in Semicircular Form for Convenience and Speed in Operation—Increased Capacity Anticipated.

One of the points of interest of the recent new South Meadow steam-turbine-driven generating station of the Hartford Electric Light Co. is the control board, which was furnished by the General Electric Co. The whole board is semicircular in form, the sections of the control board aligning radially with the corresponding sections of the instrument board. The instrument board stands back of the control board with an interval of approximately 4 ft., so that it is convenient for the operator to walk in the space between the two boards. The meter board is placed back to back with the instrument board at a distance of about 4 ft., and grilles fitted with board doors are placed at each end.

As it is at present the board controls a station capacity of 50,000 kv-a. at 11,000 volts, 3 phase, 3 wire, but the ultimate capacity of the station will be over 160,000 kv-a. not including the five underground lines of the company's existing Dutch Point station which is approximately 4000 ft. from South Meadow Station. In addition to

the main board there are the boiler room board, turbine board, battery control board, and numerous smaller panels. The battery board will furnish control, ultimately, for two 60-cell batteries in parallel.

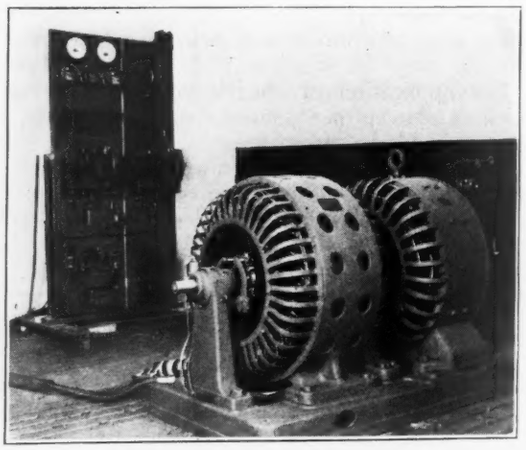
Special attention has been given to the protection of all feeder circuits. Each feeder is equipped with three type 1-A induction relays, one of which is connected in the *Y* lead of the current transformers to take care of grounds.

To give some idea of the size of the board it is interesting to know that over 800 sq. ft. of black Monson slate was used to make the panels, and 900 ft. of standard 1.25-in. pipe was used for mounting. The meter board will mount 30 watt-hour meters, and the instrument board 130 instruments. Among the many oil circuit-breakers in the control equipment at present are 12 H-type breakers.

DEMONSTRATION OF APPLICATION OF AUTOMATIC SWITCHING.

Trials Show Ability of Automatic Control to Operate and Protect Equipment Under Variety of Conditions.

A demonstration of unusual interest to the mining industry was recently conducted at the works of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., before a



A 150-Kw. Mining-Type Synchronous-Motor-Generator Set and Control Panel.

body of prominent engineers and mine operators from the Pittsburgh, West Virginia, Kentucky, Illinois and the anthracite districts. The purpose of the demonstration was to show the applicability and operation of automatic substation equipment as particularly adapted to coal mines. Much interest has been manifested in this subject recently by the street railways, and many successful installations have been made, but this is said to be the first attempt to apply the fundamental principles of automatic switching to mining conditions. The demonstration aroused considerable enthusiasm, indicating that the new idea will prove popular.

A 150-kw. mining-type synchronous-motor-generator set with control panels involving the latest use of the principles of automatic switching was used in the demonstration. The equipment was first described and explained, after which the visitors were taken to the test floor to watch its actual operation. The functions performed by the apparatus were as follows: Automatic starting and stopping by closing and opening the a-c. source of supply; automatic starting and stopping by pilot-wire control; short-circuit on d-c. side, showing the self-restoring feature; overload gradually applied, showing action of self-restoring contactor; attempt to start on single-phase energy supply; attempt to start with a reversed phase; stopping and locking out by bearing thermostat, and demonstration of action with reversed d-c. polarity.

A thorough discussion of the economic reasons for installing this equipment brought out the facts that by its use the services of one or two attendants could be dispensed with. Delays due to interruptions in service and dependent upon the human element for correction may be materially reduced or altogether prevented. The substation can be located at the most advantageous point of operation near the work to be done, thus avoiding transmission losses and the costly results of low voltage on locomotives and cutting machines.

Although this demonstration involved only the operation of a mine motor-generator set the same principles have been applied to rotary converters used in mine service with equally successful results. A new and ingenious self-restoring circuit-breaker designed and developed to meet the particular requirements of this application received the commendation of those present.

INDIVIDUAL MOTOR DRIVE APPLIED TO DROP HAMMERS.

Elimination of Shaft and Belt Drive Facilitates Use of Crane Over Hammers and Permits Freedom in Installation.

Application of individual motor drive to machine tools of various sorts has been extended to the equipment of several board drop hammers in the plant of the General Electric Co. at Schenectady, N. Y. The drive was originally applied as an experiment to a 300-lb. hammer, and it proved so successful that the range has been expanded to include hammers of 600, 1500 and 2500-lb. sizes. This is believed to be a new application for individual motor drive. The design is the same in all cases, except for variations made necessary by the increased weight of the hammer. The only basic change since the first ones were installed is the use of induction motors instead of d-c. motors for the drive. As seen by the illustrations the whole outfit consists of two towers, one composing the hammer mechanism proper and the other serving to support the far end of the platform carrying the motor, gears, etc. The supporting frame is a light structural steel tower on which is mounted the starting switches for the motor.

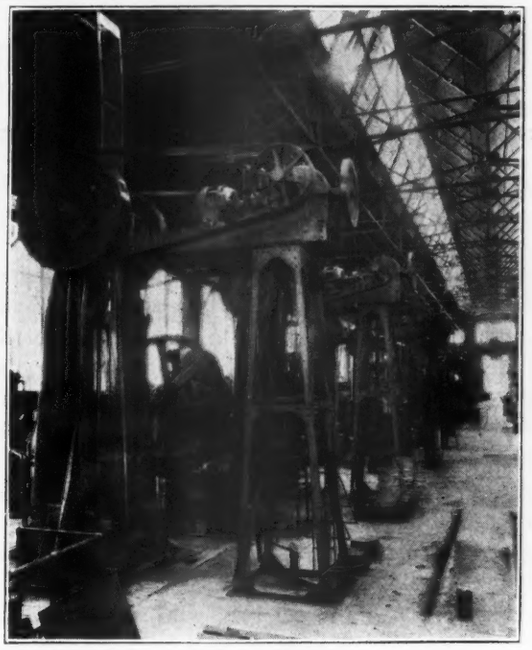
The operation is very simple. A 15-hp., 800-r.p.m., 40-cycle induction motor is directly coupled to a shaft carrying one loose and one keyed pinion and a flywheel on the extreme end. The flywheel serves to take the initial peak load off the motor when the hammer is drawn up. The keyed pinion engages two beveled gears which are directly connected to two pulley wheels. The

loose pinion simply acts as a spacer on the opposite side of the bevel gears. This arrangement of gears causes the two pulleys to revolve in opposite directions, and these are belted to the pulleys on the shafts of the rollers which when forced together raise the hammer. The gearing is all inclosed and immersed in oil. The total speed reduction of eight to one is made through the gears and pulleys.

When the motor is started it runs continuously, operation of the hammer being obtained through a treadle control which separates the rollers and lets the hammer down. The length of the drop is controlled by an adjustable trigger on the hammer frame which comes in contact with a wooden stud on the hammer. Repeated blows can be obtained automatically by this arrangement as long as the treadle is depressed. Individual motor drive for hammers of this sort has been found to have numerous advantages over the complicated shaft and belt drive hitherto used. One of the most salient of these is the possibility of running a crane directly over the hammers, which was impossible with a shaft drive. The motor drive also removes the necessity for a system of braces, both for the shaft and the hammer frame which was necessary to maintain proper alignment. As a result the hammer can be placed wherever it is most convenient with respect to furnaces, shears, etc. By having the crane overhead repairs to or dismantling of the hammer is a comparatively simple matter.

Another feature of importance is that the driving pulleys never get out of alignment owing to vibration of the hammer or for other causes. Since the gear train obviates the use of a twisted belt to get opposite rotation of the rollers there is no difference in speed between them, such as might exist owing to difference in the belt tension.

Motor-Driven Billing and Spencer 600-lb. Drop Hammer.



View Showing Installation of 2500-lb. Drop Hammer.

NEW RAILROAD LINES PLANNED IN VENEZUELA.

With the strengthening of diplomatic and commercial ties between the United States and Venezuela, the improvement of the existing railroads of the latter country and the building of new lines are brought definitely nearer. There are at present 12 railroad systems in Venezuela with a combined length of 600 mi. and $40,000,000 of invested capital. In addition, the building of four new roads is being considered. One of these would connect a fertile cacao region with the coast, the second would run through rich cattle, coffee, cacao and tobacco lands, the third would bring the product of the country's rich oil fields to a deep water port, and the fourth would make it possible to ship machinery to the Yuruari gold mines, which are now being worked only in a primitive way, and at the same time, would tap rich grazing lands and extremely valuable fields of iron ore.

American capital is welcomed in Venezuela by the government, which is pursuing a very liberal policy toward foreigners. Recent laws guarantee railroad builders against the construction of rival lines paralleling their routes, and against oppressive taxes. Railroads are assured of a fair proportion of unclaimed lands, of the right to erect telegraph and telephone lines and of the exemption of their employes from military service except in the case of international war.

The Public Utilities Commission has ordered the Potomac Electric Power Co., Washington, D. C., to reduce its lighting rate to $0.08 per kw-hr. The prevailing charge has been $0.10.

EDITORIAL COMMENT

Are You Operating on the Back of the Curve?

A stitch in time saves nine. This expression was quite common a few years ago and grandmothers were much given to repeating it to the little children of the family, probably with the idea of impressing on their minds the value of thrift. But it is probable that in many cases the true meaning was never grasped by the youthful listeners. How could there be a stitch taken in time, and what would be done with nine if it were saved? These are some of mental questions that may have been provoked by the well meaning admonitions of the old lady who sought to help her young friends to avoid some of the hardships and failures of life. And many of us have never taken seriously the real truth of this old adage, although it has a parallel in every walk of life. The line superintendent might reword it, saying, "A pole in time saves the line."

There are a number of ways of saying this same thing. Probably everyone who ever went to school has heard all or part of the old recitation about the battle that was lost for the want of a horseshoe nail. But what has all this to do with the electrical industry? Just this: There seems to be, at the present time, a lack of realization that a stitch in time saves nine, that a substantial repair may save a generating unit, or that a little spare capacity may save the reputation of the industry. No operating man worthy of the name will allow his equipment to fall into a state of decay if unhampered in his work. Neither will he waste money on needless work or equipment, for all such needless expenditures only require money that he could spend to better advantage.

It is the object of every manager to so regulate his property that it will operate at the lowest possible unit cost. There is no easy guide to just how this can be done, and as a result many properties do not operate at anything like the lowest cost. Every engineer knows the shape of the curve between investment and unit cost of product for any enterprise with a given amount of business available. The curve starts high and slopes down as the investment increases until a minimum is reached, and then it slopes up again. Right at the bottom of the curve is the best place to work, but the exact bottom is not always easy to locate. In fact, the bottom of the curve is often a fairly flat or almost straight line for a considerable distance. As a consequence many managers choose to hold down the investment to a point just back of the flat spot at the bottom of the curve. This choice results in a low investment charge per unit of capacity and would seem to indicate thrift and discretion. But this choice overlooks the fact that the electrical industry is growing.

In the case of a central station business where the investment is limited to a point just back of the bottom of the curve, every new customer added to the system increases the load and so decreases the total efficiency, thus increasing the unit cost of production. In time this increase in customers and unit cost of production eats up any revenues that may exist. It may be that the manager will be commended for having kept down the investment and so saved the loss of revenue from a still larger sum. But should he be commended, or was his policy correct?

The cost curve, as has been stated, is flat for a time and then goes up. If this same central station manager had wisely pushed his investment just beyond the flat spot on the curve his situation would have been decidedly different. The total unit production costs would be the same as with the under investment, and at the same time there would be a little spare capacity available. In addition to this the adding of a new customer would tend to reduce production costs instead of increase them. Under such circumstances the manager could well afford to undertake a new business campaign. In fact, he could not afford to neglect his new business department for a single day. With new business and an increasing margin of profit there is no difficulty in securing the needed capital to maintain the property just ahead of the bottom of the curve, and the important and interesting feature of the entire proposition is that it costs no more to operate with perfect security than it costs to operate just one step in advance of failure.

The electrical industry, particularly the central station branch, has been operating now too long on the back up-slope of the curve, and it is time to get away from the perpetual fear of the winter peak, or a weak pole line, or whatever it may be in each individual case. A stitch in time still saves nine, and in the central station business it may be 9000 instead of the small figure. It is time to look the situation squarely in the face, take stock of conditions as they are, and get on the forward up-slope of the curve where there is room for progress to be made. Old equipment

must be put in shape, and new equipment must be purchased in order to catch up with the situation. It may be an unpleasant task, but it must be done unless we expect to see the industry fall into decay for the lack of courage and constructive optimism.

There are certain broad visioned men in the country who are now putting their property into proper condition. It is not necessary to name them for the industry already knows where real advancement and progress is being made. It is in these places that the properties are being pushed forward to the front of the ourve.

Peter Cooper Hewitt

Science, and particularly electrical science, has suffered an unusual and far-reaching loss in the death of Peter Cooper Hewitt, who died in the prime of life from an operation in Paris last week. It came at the height of his career with apparently many years of earnest, useful work ahead of him.

His greatest distinction came from his original and highly valuable efforts in the field of lighting, and the Cooper-Hewitt lamp will ever be a monument to his name, which is entitled to a prominent place among distinguished inventors of the world. He was the son of a great mayor of New York City and grandson of a true philanthropist, Peter Cooper.

Born in fashionable society and to wealth, he was one of those men who scorn delights and live laborious days. He was an inventor. He was a master of research. His years, which ended all too soon, were crowded with successful achievements—a success that pointed to still greater achievements in the future.

The following is taken from the editorial columns of the New York *Herald,* and we gladly give space for this deserved tribute in the columns of the ELECTRICAL REVIEW. Under the heading, "A Great Heir of Great Names" (referring to Peter Cooper, his grandfather, and Abram S. Hewitt, his father) the *Herald* speaks of the deceased in these terms:

> Against the historic background erected by these giants Peter Cooper Hewitt built. He was born to wealth, to assured position, to ease, had he chosen it. But the blood of his forebears denied him the purposeless luxury of a vacant life. His mind and heart were impelled to service. In productive labor he spent his busy years. His eager curiosity led him as a pioneer into many fields; in all of them he tilled unselfishly for the benefit of all. He inherited and displayed in his daily labors the genius and high resolve of the men whose names he bore, and did them proud in the place he made for himself.
>
> The reputation he won in his lifetime did not do justice to his accomplishments; the full fruitage of his genius is yet to be reaped. Years may pass before the world generally understands how profound and fundamental were his contributions to the conquest of nature by man, and to the subjugation to beneficient uses of the forces upon control of which modern civilization is dependent.
>
> That the peoples of the earth were his debtors had long been acknowledged; how deep their debt is no man can now say. On the foundations laid by his patient industry, untiring research and the genius of a splendid mind other men in days to come will build with confidence and success for the enduring good of the human race.

Good Profits and Low Prices

The month of August developed an unmistakable renewal of business activities. Confidence is returning in many industries, and is inspiring others. The improved efficiency of organization and methods secured during the era of depression we have passed through will undoubtedly increase the economical output and stimulate on an expanding scale industries in all fields.

A recent publication by the Irving National Bank of New York, one of the strongest and most influential commercial institutions of the United States, contained the following pertinent and valuable suggestions:

> It is natural to assume that there must be some further oscillation in price averages before business generally can adjust its sails to new conditions and forge ahead on an even keel. An illustration of the many readjustments awaited is afforded by the iron and steel industry which has been slower than other basic industries in adapting itself to the inevitable. As average quotations of iron and steel products continue to recede, hundreds of special lines such as tools and machines of all sorts, hardware, building and railroad supplies can probably be made more cheaply, thereby in turn lowering the costs of unnumbered articles of commerce or services at home and abroad. The conviction is gaining ground that profits can be good even with lower prices, providing that unit costs are effectively controlled through proper managerial organization and wise choice and training of personnel.

We would like to again state that the company that today is keeping its name before the public and is sending out its best missionaries will most assuredly reap the earliest and most substantial returns.

High-Voltage Transmission

Transmission voltage and frequency problems have presented themselves at every step in the advancement of the electrical industry. Switches, transformers, insulators, generators and a great variety of smaller details depend in some measure on the standards of voltage and frequency adopted. Frank S. Baum, consulting engineer, San Francisco, presented a rather exhaustive paper dealing with regulation and insulation of high-voltage lines of large capacity at a recent convention of the American Institute of Electrical Engineers. He recommended the use of 220,000 volts and 60 cycles for long lines, and discussed the regulation of lines up to 800 mi. in length. The conclusions drawn in regard to line insulation were substantially as follows:

"The insulation problem, as does every other engineering problem, reduces itself to working to certain unit stresses—mechanical and elec-

trical—and to the maintenance of certain factors of safety throughout the entire line structure which includes insulators, towers, switches, transformers, etc. This factor of safety should be as permanent as possible, which means that the depreciation of the insulator should be practically nil in service.

"It has been shown that satisfactory voltage distribution at normal voltage may be obtained by different methods of shielding or by different methods of grading. Further work along this line is desirable in order to crystallize the best methods into practical forms so that the insulator manufacturers will be able to furnish the complete line insulation equipment.

"It is believed that 220,000-volt transmission is no more difficult than 110,000 or 175,000-volt transmission if due consideration is given to the unit air and leakage resistance stresses, and the insulation of the line is carried out consistently as is, for example, the track system of our best railways. But this means, of course, that we must not have on a main-line track both 120-lb. rail and 60-lb. rail over which high-speed trains run.

"Double-string and dead-end insulator strings should be avoided wherever possible, and in place of these extra-strength units should be used to allow insulators to swing clear at angles as far as possible.

"Higher voltages than 220,000 are possible, but for practical reasons it is believed that 220,000 volts should be standard for high-power, long-distance transmission. Heretofore I have always said we would go to higher voltages, because we had not reached the voltage required for extra large blocks of power and long distances. I believe 220,000 volts is high enough to meet any situation in this country today.

"It is the peculiar characteristic of nearly all electrical apparatus that it depreciates less when used in normal service than when taken out of service for part of each day. This is because the depreciation depends largely on the maximum range of temperature changes and the number of such changes or cycles in a given period. All electrical apparatus, including transmission lines, should be in constant service under conditions that will as nearly as possible cause the apparatus to remain in one condition. It is believed transmission lines will give better service when voltage is maintained on them at all times.

"A system of transmission controlled as to voltage, and insulated consistently, as outlined in the body of the report, to give low air and resistance leakage stresses at all voltages and under all conditions, will give service not possible on lines where such conditions are not carried out. I hope to see a real era of 220,000-volt transmission construction in the next few years, and the engineers and manufacturers can help matters along by proper co-operation."

Theory and design are already so far advanced in connection with high-voltage transmission that the construction of equipment for operation at 220,000 volts has already been undertaken, and in a short time we may expect to hear that service has been initiated at this pressure in California. It would seem now that much of the first pioneering work had already been done in connection with high-voltage transmission, and that the task open for the near future should include the organization of plans to make use of present knowledge and the actual development of properties. There is, of course, still much work to be done in the matter of refinements, but it would seem that there would not be a great call for voltages higher than would be required to transmit energy a third of the way across the continent. Even if higher voltages are required the task of advancing upward from the level already reached should be simple indeed in comparison with the labor required to attain the present standards.

Steam Turbines in Standby Service

In converting a steam turbine plant to standby operation for a distant hydroelectric system, some of the problems that enter into the work consist of changing the governor characteristics of the steam turbines to permit better parallel operation with the water turbines, a method of cooling steam-turbine blading while the machines float on the line ready to pick up load, an operating schedule for interchange of power between the two systems, methods of testing transmission lines so as to reduce line disturbances and protecting them while lightly loaded, as well as possible improvements in boiler-room practice, regulation of the water supply, and methods of preventing deterioration in plant efficiency during such auxiliary service. These are questions which will come up more and more for consideration as the water-power resources of the country are developed, particularly from low-head installations in the vicinity of large manufacturing centers, and they are worthy of far more study than has been given them up to the present time.

Recording Overload

Although the induction watt-hour meter is both accurate and reliable, it often lags far behind the desired standard under the heavy overloads to which it is submitted. A curve straightener which permits the accurate recording of heavy loads by a small meter is the solution of the difficulty.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

INDIANA ELECTRIC UTILITIES PLAN HUGE MERGER.

The Indiana Electric Corp., Indianapolis, recently organized, is arranging for a merger of public utility interests in that section, following which it is proposed to construct a large power plant on the Wabash river, near Terre Haute. The companies to be consolidated include the Merchants Heat & Light Co., Indianapolis; Indiana Railways & Light Co., Kokomo; Putnam Electric Co., Greencastle; Wabash Valley Electric Co., Clinton; Valparaiso Lighting Co., Valparaiso; Cayuga Electric Co., Cayuga, and the Elkhart Gas & Fuel Co., Elkhart.

The merger is arranging for a bond issue of about $5,000,000 to provide funds to effect the consolidation, power plant construction, line extensions, etc. The proposed new generating station will have an initial capacity of 30,000 kw., with transmission system connecting with the present lines of the organization. The new plant is estimated to cost more than $2,000,000.

The new company is headed by Joseph H. Brewer, president of the American Public Utilities, Inc., Grand Rapids, Mich.; Charles O'Brien Murphy and Paul D. Birdsall, vice-president and general manager, and secretary, respectively, of the Merchants Heat & Light Co. Authority to effect the merger is being asked of the Indiana State Public Service Commission.

GREAT LAKES DIVISION OF N. E. L. A. PLANS BIG MEETING.

Indiana State Electric Association Is Preparing to Participate Jointly in Elaborate Program Covering Subjects Vital to Industry.

Every indication points to a large and enthusiastic gathering on the occasion of the first annual convention of the Great Lakes Division of the National Electric Light Association which will meet jointly with the Indiana State Electric Association at French Lick Springs, Ind., Sept. 21-24.

The elaborate program, of vital importance to the electrical industry, will soon be ready for distribution. Among those who will participate in this program are George P. Bernard, member, Public Service Commission of Indiana; Dr. Arthur Holmes, president, Drake University; Milan R. Bump, president, National Electric Light Association; Martin J. Insull, chairman, Executive Committee, National Electric Light Association; M. H. Aylesworth, executive manager, National Electric Light Association; William C. Lounsbury, president, Great Lakes Division, National Electric Light Association; John F. Gilchrist, vice-president, Commonwealth Edison Co., Chicago; B. J. Mullaney, Illinois Committee on Public Utility Information, Chicago; R. T. Duncan, Detroit Edison Co.; F. A. Bryan, Indiana & Michigan Electric Co.; F. A. Newton, Consumers Power Co.; J. C. Langdell, Hodenpyl-Hardy Co.; G. E. Lewis, Detroit Edison Co.; B. P. Shearon, Northern Indiana Gas & Electric Co.; John G. Learned, Public Service Company of Northern Illinois; H. J. Burton, Consumers Power Co.; J. H. Thomas, Central Illinois Light Co.; H. C. Mitchel, East St. Louis Light & Power Co.; C. H. Hansberger, Consumers Power Co.; W. A. McDonough, Beloit Water, Gas & Electric Co.

Delegates and other visitors to the convention are urged by Thomas Donohue, chairman of the Hotel Committee, to make their hotel reservations direct with the French Lick Springs Hotel Co., calling attention to the convention in order to obtain the special rates to be provided for the occasion.

The Transportation Committee, of which W. H. Colman is chairman, has arranged for a special train from Chicago, via the C. I. & L. railway, (Monon Route) leaving the Dearborn station Tuesday evening, Sept. 20, at 9 p. m., standard time, arriving at French Lick at 7 a. m. Wednesday. The railroad fare from Chicago to French Lick is $10.85 each way, including war tax. In order to secure this special train it will be necessary for the Transportation Committee to receive reservations as early as possible before Sept. 15. Special train reservations must be sent to W. H. Colman, care of the General Electric Co., Monadnock block, Chicago, sending a copy of the reservation to your state association secretary at the same time.

Morse Dell Plain, Hammond, Ind., is chairman of the Program Committee. He has his work practically completed. The entertainment will be provided by the Indiana State Electric Association and ample arrangements have been made for the entertainment of the lady visitors. In addition, there will be a golf tournament for the men.

President William C. Lounsbury has sent out the following letter to the executives of all member companies in the Division:

To Executives of Member Companies:

Many of the leaders of our industry have come to believe the large National Electric Light convention should be restricted, and that the Geographic Divisions offer the most effective units for committee work and interchange of ideas.

Our four states have a great deal in common. The Great Lakes Division convention is going to offer an unprecedented opportunity for full discussion of our local problems. The committees have done good work and their reports will warrant careful study.

Too, the future work of the National Electric Light Association will be greatly influenced by the attendance and spirit manifest at our meeting. Will you help swell our attendance?

This convention will be pregnant with inspiration. President Bump, Martin J. Insull and Executive Manager Aylesworth are all to be present. The program will reveal sessions you yourself will want to attend

and you will also want your men to attend.

French Lick Springs, Ind., is the place, and Sept. 21-24 the time. The big day is Friday, the 23rd.

WILLIAM C. LOUNSBURY,
President.

SPACE AT NEW YORK ELECTRICAL SHOW NEARLY ALL TAKEN.

This Year's Exposition Will Contain Practically All Phases of Late Electrical Development and Central Station Operation.

So great has been the interest on the part of electrical manufacturers and dealers in the coming electrical show in New York City, as seen in their requests for space, that practically all of the armory has been disposed of. On Aug. 6, nearly 2 mo. before the scheduled opening, there were only 12 spaces left. Never before in the history of the New York show has the demand for space made itself felt so far in advance of the opening. The show is to be held at the 71st Regiment Armory, Park avenue and 34th street, instead of the Grand Central Palace. It will open on Sept. 28 and continue 10 days.

This year's show, as those of former years, will cover a great number of the uses of electricity. Appliances for reducing labor in the home will make up a large part of the show. Among these exhibits will be laundry equipment, kitchen appliances, refrigerators, house lighting fixtures and an apartment completely equipped with wired furniture.

Central station displays will be made by the lighting companies which serve the New York City territory. They will not only explain the commercial practices of the companies but will illustrate some of the operating methods. There will be a number of displays by manufacturers of electrotherapeutic apparatus. These will include large equipment for hospitals and offices and some of the smaller devices for use in the sick room at home. Several types of electric signs will be exhibited, and it is probable that an animated display will cover one of the armory walls.

The electric vehicle exhibit will be very comprehensive and will include displays of the truck manufacturers and the makers of electric storage batteries and garage accessories. Industrial trucks will play an important part in the show for they will be used to move all the exhibits into the armory. A ramp will be built from the street level up to the armory floor and the industrials will carry their loads up this and make delivery right at the exhibitor's booth. This will eliminate all rehandling of shipments.

PARTIAL LIST OF EXHIBITORS AT NEW YORK ELECTRICAL SHOW.

Following is a list of the greater number of exhibitors who have taken space for the 1921 show:

Gould Appliance Co., Inc.
Appliance Distributing Corp.
J. L. Lund Manufacturing Co.
Manhattan Electrical Supply Co., Inc.
W. & J. Sloane.
Air-O-Mix Corp.
Gage Publishing Co.
Lyons & Jourdan.
Bleadon-Dun Co.
Landers, Frary & Clark.
Willcox & Gibbs Sewing Machine Co.
Premier Service Co.
Hurley Machine Co.
Ohio Electric Co., Inc.
Gillespie-Eden Corp.
ELECTRICAL REVIEW.
Electric Storage Battery Co.
Clothel Refrigerating Co.
Yonkers Electric Light & Power Co.
Westinghouse Electric & Manufacturing Co.
Disbecker & Co.
Hoover Suction Sweeper Co.
Radio Corporation of America.
Wallace B. Hart.
Lightolier Co.
C. C. Bohn Electric Co.
Shelton Electric Co.
Laun-dry-ette Sales Co.
Wiebusch & Milger, Ltd.
Western Electric Co., Inc.
W. A. Buerkle Sales Co.
Home Devices Corp.
Manning Bowman Co.
Home-Helps Manufacturing Corp.
Electrical Testing Laboratories.
Alpha Electric Co.
H. G. Weeks Manufacturing Co.
Regina Co.
Aqua Electric Heater Co.
Colgate & Co.
The Torrington Co.
The Rawlplug Co.
Lombard-White Co.
Electrical World.
New York & Queens Electric Light & Power Co.
United Electric Light & Power Co.
George Spalt & Sons, Inc.
Edison Electric Appliance Co., Inc.
Fox Electrical Corp.
Eureka Vacuum Cleaner Co.
Singer Sewing Machine Co.
Consolidated Telegraph & Electric Subway Co.
Tremont Products Co.
Phenix Lighting Fixture Co.
Electric Phonograph Corp.
Viking Sign Co.
Hanovia Chemical Manufacturing Co.
J. M. Collins & Co.
Equalite Sign Co., Inc.
Rutenber Electric Co.
Simplex Utilities Corp.
Continental Radio & Electric Corp.
New York Tribune.
Dann Icer Sales Co.
Edison Storage Battery Co.
Fink-Dumont-White, Inc.
Wm. H. Jackson Co.
Commercial Truck Co.
Lansden Co.
Ward Motor Vehicle Co.
Walker Vehicle Co.
Steinmetz Electric Motor Car Corp.
Rauch & Lang, Inc.
K-W. Storage Battery Co.
General Lead Batteries Co.

GOODWIN TAKES GOSPEL OF S. E. D. INTO NOVA SCOTIA.

Carrying on his field work for The Society for Electrical Development, "Bill" Goodwin took a leading part in the first annual meeting of the Electrical Association of Nova Scotia, which opened in Halifax on Aug. 16.

The principal speakers at the convention from outside the Dominion were W. D'Arcy Ryan, Samuel A. Chase, E. W. Rockafellow and W. L. Goodwin. Mr. Ryan was welcomed as a fellow "Bluenose," being a native of Kentville, N. S.

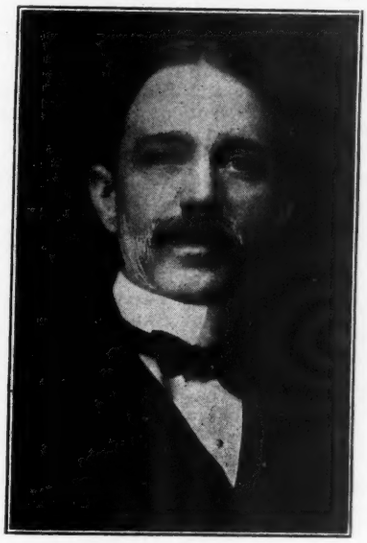
At a lecture open to the public in the Strand theater, Mr. Ryan talked on the most modern methods of illumination. This lecture was of particular interest to the residents of Halifax

PETER COOPER HEWITT, EMINENT SCIENTIST, IS DEAD.

Noted Electrical Inventor Succumbs to Pneumonia Following an Operation in Paris—Valuable Service Given Science and Industry.

Peter Cooper Hewitt, American scientist and electrical inventor, died in the American Hospital in Paris, Aug. 25, of pneumonia, following an operation.

Peter Cooper Hewitt, electrical and mechanical inventor and engineer, bore by inheritance the names of two among the most eminent New Yorkers of a preceding generation. His father



Peter Cooper Hewitt.

was Abram Stevens Hewitt, a leading iron manufacturer and merchant, representative in Congress, mayor of New York City and promoter of many civic, educational and philanthropic causes. His mother, Sarah Amelia (Cooper) Hewitt, was a daughter of Peter Cooper, inventor, manufacturer, railroad builder and benefactor of New York in the gift of the Cooper Union for the advancement of art and science, more commonly known as Cooper Institute. He was born in New York City March 5, 1861, and was educated at the Stevens Institute of Technology, at Hoboken, and at Columbia University School of Mines.

In boyhood he manifested a strong inclination toward mechanics and his courses of study were directed toward the mechanical, chemical and electrical sciences, in which he developed much proficiency. One of his earliest inventions was that of improved machinery in his grandfather's famous glue factory and this was followed with new forms of centrifugal machines, evaporators and other devices for use in breweries. The early experiments in motor vehicles and flying machines enlisted his interest and he made a number of inventions relating to them. But about 1898 he began to devote serious attention to electrical science and in that field achieved his greatest successes.

Perhaps the best known of his electrical inventions is the so-called "Cooper Hewitt lamp." It consists of a long glass tube, suspended in a nearly horizontal position and containing mercury which is vaporized by electrical action. The flow of the electric current through the vapor causes the whole tube to glow with a bright light, eight times as strong as an incandescent light produced by the same energy—but very much cooler—the electrical energy going into light rather than heat.

Another of his electrical inventions is the "Cooper Hewitt rectifier," called by Lord Kevlin a "static converter." It is used to transform alternating current so that direct-current machinery can be used where only an alternating current is available. Another is an electrical interrupter, which is used for turning off powerful high-tension current and for automatically making and breaking a circuit. Still another device is his wireless telegraph receiver, in which by the use of mercury vapor he attained a notably high degree of sensitiveness.

In the domain of aeronautic, Mr. Hewitt made elaborate studies and experiments in the efficiency of inclined surfaces acting either as gliding planes or as propeller blades, which culminated in 1907 in his construction of a hydroplane or gliding boat, with four sets of gliding planes, each set consisting of several planes in tiers. The hull of the boat is lifted and held entirely above the water by the dynamic action or reaction of the water against the inclined surfaces of the planes.

Because of his scientific attainments, during the world war Mr. Hewitt was made first vice-chairmain of the United States Naval Consulting Board, of New York, and in that capacity did much valuable patriotic service. He was a director or trustee of the Cooper Hewitt Electric Co., the Hewitt Realty Co., the Hexagon Realty Co., the Lehigh & Oxford Mining Co., the Midvale Water Co., the Madison Square Garden Co., the New York & Greenwood Lake Railroad Co., the Cooper Union and the House of Rest for consumptives. He was a member of the American Institute of Electrical Enginers, the American Physical Society, the American Geographical Society, the Society of Naval Architects and Marine Engineers, the New York Society of Electrical Engineers and the General Society of Mechanics and Tradesmen, and also of the Century Association, the Aero Club of America, the Automobile Club of America, and the Union, Knickerbocker, Manhattan, Engineers, Players', Lambs', Brook, Racquet and Tennis and Tuxedo clubs.

Mr. Hewitt received the honorary degree of Doctor of Science from Columbia University in 1903 and from Rutgers College in 1916. His home for many years was at Ringwood Manor, N. J.

owing to the probability that that city may have a new street-lighting system soon. Mr. Goodwin, in his talk, dwelt on the growth and expansion of The Society for Electrical Development and pointed out to the members of the new Nova Scotia Association methods by which they could advance their profession and at the same time render greater service to the public. He indicated the necessity of demonstrating to the public the value of electrical labor saving devices which are destined to supplant the older makeshifts so frequently found in present day homes.

The motto originated by the S. E. D., "Do It Electrically" was featured prominently by the new association. Over the entrance to the Technical College where the meetings were held was stretched a great panel bearing the above slogan. Samuel A. Chase, of the Westinghouse Electric & Manufacturing Co., also delivered an address along lines similar to Mr. Goodwin. After leaving Halifax Mr. Goodwin continued westward carrying the Society's co-operative work to other cities in Canada.

GENERAL ELECTRIC MAY CHANGE STOCK DIVIDEND PLAN.

Profits of the General Electric Co. in the current year promise to be sufficient to cover the cash and stock dividend requirements for the period, according to a statement issued to stockholders by C. A. Coffin, chairman of the board. The company has in excess of $40,000,000 cash on hand, has large receivables and no current liabilities other than monthly accounts and Federal taxes. The yearly rate of orders received for the first 33 wks. of 1921 is $180,440,000. Chairman Coffin says that so far as can be foreseen no financing on the part of the company will be necessary for some years.

These facts are made public in a letter sent out to stockholders announcing a change in the policy of the company with regard to the payment of stock dividends. The management has decided for the better protection of its small shareholders to inaugurate in the near future dividends of $5 a share in stock annually in place of the 2% semi-annual dividend in stock now being paid.

The new dividend will be in special shares of $10 par, entitled to a fixed cash dividend of 6% per annum, but without rights to participate in new future issues of the present stock. This means that each holder of two shares of the present stock will receive one certificate of $10 of a fixed dividend stock, thus enabling the small shareholder to conveniently add to his stock holdings through the medium of stock dividends.

The company desires to put the new plan into operation at the earliest practicable date, but as appropriate legal and corporate action must first be taken, involving some delay, it is the purpose of the company to pay on Jan. 15, 1922, the stock dividend of 2% in the present stock of the company, together with the usual cash dividend.

New discoveries in the leather tanning process which are expected to bring down the cost of shoes will be discussed at the meeting of the leather chemistry section of the American Chemical Society in New York City, Sept. 12.

COMING CONVENTIONS.

New England Geographic Division of the National Electric Light Association. Annual convention, New London, Conn., Sept. 6-9. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, 149 Tremont street, Boston.

International Association of Municipal Electricians. Annual convention, Colorado Springs, Colo., Sept. 6-10. Secretary, Clarence R. George, Houston, Tex.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 7-10. Secretary, Henry M. Stine, 211 Locust street, Harrisburg, Pa.

National Exposition of Chemical Industries, Eighth Coast Artillery Armory, New York City, Sept. 12. Secretary, Charles L. Parsons, 1709 G street, N. W., Washington, D. C.

Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association. Joint annual convention, Glenwood Springs, Colo., Sept. 19-21. Headquarters, Hotel Colorado. Secretary, Minnie B. W. Baker, 900 Fifteenth street, Denver, Colo.

Association of Iron and Steel Electrical Engineers. Fifteenth annual convention, Chicago, Sept. 19-24. Headquarters, Hotel La Salle. Secretary, John F. Kelly, Empire building, Pittsburgh.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Annual convention, Huntington, W. Va., Sept. 20-22. Secretary, Herbert Smith, 212 Robson-Pritchard building, Huntington, W. Va.

Great Lakes Geographic Division of the National Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 21-23. Secretary, R. V. Prather, 305 De Witt Smith building, Springfield, Ill.

Indiana State Electric Association. Joint meeting with Great Lakes Geographic Division of the National Electric Light Association, French Lick Springs, Ind., Sept. 21-23.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-29. Headquarters, Powers hotel. General secretary, Clarence L. Law, 29 West 39th street, New York City.

American Electrochemical Society. Meeting at Lake Placid Club, N. Y., Sept. 29-Oct. 1.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. General manager, George F. Parker, 124 West 42d street, New York City.

Cleveland Section of the American Society of Mechanical Engineers. Great Lakes regional meeting, Cleveland, Oct. 3-4. James Guthrie, Fidelity building, Cleveland.

Indiana State Association of Electrical Contractors and Dealers. Annual convention, Indianapolis, Oct. 5-6. Headquarters, Claypool hotel. Secretary, A. I. Clifford, 507 Odd Fellows building, Indianapolis.

Indianapolis Industrial Exposition, Indiana State Fair Grounds, Oct. 10-15, under auspices of the Indianapolis Chamber of Commerce. Chairman, O. B. Iles, Chamber of Commerce building, Indianapolis.

Southeastern Geographic Division of the National Electric Light Association. Annual convention, Chattanooga, Tenn., Oct. 17-19. Headquarters, Signal Mountain Inn. Secretary, Charles A. Collier, Electric and Gas building, Atlanta, Ga.

Electrical Exposition, Auditorium, Milwaukee, Oct. 25-31, under auspices of the Milwaukee Chapter of the Wisconsin State Association of Electrical Contractors and Dealers, in connection with the Third Annual Food and Household Exposition, directed by the Milwaukee Journal.

National Council of Lighting Fixture Manufacturers. Annual convention and Lighting Fixture Market, Auditorium, Milwaukee, Jan. 30-Feb. 4. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Cleveland.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

FUNCTION OF THE DRAFT TUBE IN HYDRAULIC PLANTS.

Extract From Paper Presented Before American Institute of Electrical Engineers by W. M. White.

The two-fold function of the draft tube is not usually understood. Its function is, first, to inclose and seal a passageway from the runner to a point below the surface of the tailwater so as to produce a suction action at the discharge from the runner at least equivalent to the difference of elevation between the runner and the level of the surface of the tailwater, and second, to transform the energy in the form of velocity head discharged from the runner into energy in the form of pressure head. This action may be a little more clearly understood by imagining a horizontal flow in which the flow at a given point is at a velocity equal to that being discharged from the runner, and further down stream where the cross-section is increased and the velocity slowed down the elevation of the water will be found to be higher than at the upper point. The amount of this height is dependent upon the efficiency with which the conversion of velocity into pressure takes place. Therefore, the second function of the draft tube is to transform that velocity head into pressure head, thus creating an added suction at the discharge of the runner equal in amount to the velocity head times the efficiency of conversion. This amount added to the difference of elevation between the bottom of the runner and the level of the tailwater gives the total added suction at the runner. By this conversion of velocity back into pressure, and by this greater suction action being maintained at the discharge of the runner, the effective head on the waterwheel and runner up to the point of the discharge from the runner is greater than the head as measured from the equivalent level back of the waterwheel to the elevation of the tailwater. Therefore, by the conversion of the velocity head into pressure head by means of some proper form of regainer, and maintaining a greater suction at the runner by means of this discharged energy, the discharged energy is thus used by the waterwheel runner for the production of effective power.

A complete vacuum will cause the water to rise to about 34 ft. above the level of the outside water, depending upon the air pressure at that particular locality and time. The height, therefore, to which a runner may be located above tailwater level is limited. We turn again to past experience for the factor fixing that height. It has been found that a runner of moderate specific speed may be placed so that the maximum suction at the base of the runner does not exceed 27 ft. theoretically. In determining the theoretical suction there is added to the elevation of the runner above tailwater the total velocity head in the water discharged from the runner; that is, to say, the efficiency of conversion is assumed to be 100%. This is the limit of good practice, and where possible, other things being equal, this should be kept lower. As pointed out previously there is a limit to which the topmost point of the runner at its discharge can be placed. When large runners are placed with shafts in horizontal position the center line of the shaft is necessarily kept low with relation to the tailwater elevation in order to keep the top of the runner at discharge within the limits as set forth. This elevation of the shaft frequently depresses the generator into the foundations below the level of high tailwater and sometimes of even normal or low tailwater. This is a good reason for the adoption of the vertical shaft. An interesting setting is that of the Kerckhoff station of the San Joaquin Light & Power Corp., where the turbine pit is excavated from granite and draft tubes are driven from the bottom of the excavation out to the river channel. This design enabled the avoidance of cofferdams which would have been very expensive at this location.

The regain of energy from the velocity discharged from the runner may be accomplished more or less effectively by (a) straight conical tubes, (b) curved draft tubes, and (c) hydraucone regainers.

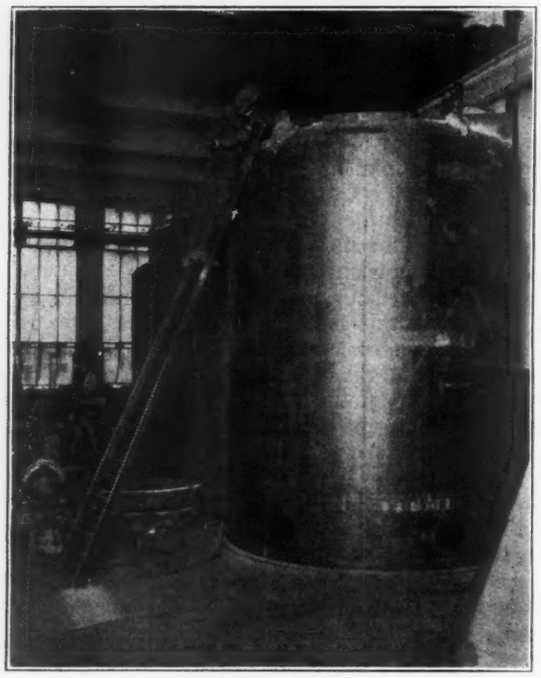
Straight conical tubes will regain the energy with high efficiency, provided the space available within the powerhouse foundations is sufficiently ample to permit the installation of a long conical tube having a length of preferably more than four times the diameter of the draft tube where it joins the runner. Most of the curved draft tubes are a delusion and a snare. Recent investigations along these lines have shown that curved tubes now in use are so poor in regaining efficiency as to seriously detract from the power plant efficiency.

The Hydraucone Regainer is a new device for regaining pressure from velocity in the limited space available within the powerhouse foundations. It contemplates spreading out the flow of the water on some form of either flat or conical plate and then placing around the surface of the stream an envelope of gradually increasing greater capacity over that required to just inclose the free shape. In the case of the proper conical center a gradually enlarging capacity may be obtained wherein the pressure from velocity is regained. The conical center is not essential as tests have proved that substantially the same results have been secured by the omission of the conical center, even in regainers having the upper walls especially designed with reference to the cone center. This result, however, may be accomplished only when a conoidal chamber does not vary too widely from the hydraucone which would be formed upon the particular base used.

The outwardly extending passages in this form of regainer increase the efficiency of the water-wheel at full and particularly at part loads, since the centrifugal force of the whirling water may be effectively utilized in these outwardly extending passages.

CIRCUIT-BREAKERS BEING BUILT FOR 220,000 VOLTS.

The accompanying illustration was made from the first picture taken of the tanks for what will be the largest oil circuit-breaker in the world, which is now under construction in the Schenectady plant of the General Electric Co. The circuit-breaker when finished will be used on a 220,000-volt transmission line of the Southern California Edison Co. The size of the tanks can be appreciated by comparing them with the size of the man who is engaged in welding on the lugs.



Welding Lugs on Tanks for 220,000-Volt Circuit-Breakers.

In fact, they are so big that instead of attempting to move them around for welding processes two portable welding sets, consisting of a motor and generator, were moved into the bay where the tanks were located, and the necessary welding done there. This illustration also shows an interesting application of arc welding.

MOTOR-DRIVEN CENTRIFUGAL PUMPS IN FILTRATION PLANT.

Service of High Character Given by Electrically Operated Pumps Working in Connection With Water System.

A plant for treating and filtering the water used in Wenatchee, Wash., was recently completed and put in service. The Columbia river is the source of supply, and the plant has a capacity to sterilize and filter 4,000,000 gals. of water per day and deliver it to the distributing reservoirs. The processes required the installation of two electric pumping plants. One of these consists of two low-lift units by which raw water is forced from the river through 300 ft. of pipe into the first basin of the filtration plant, making a lift of 55 ft. The other pumping plant, containing two high-lift units, serves to deliver the treated and filtered water from the clear-water basin through long pipe lines into two different reservoirs, involving a lift of 250 ft. at one reservoir and 165 ft. at the other.

DeLaval centrifugal pumps and Westinghouse motors constitute the essential features of the two pumping plants. The first unit of the installation for raw-water pumping consists of an 8-in. single-stage, double-suction pump of the capacity of 1800 g.p.m., operating with a head of 55 ft. The pump is driven at a speed of 1750 r.p.m. by a Westinghouse 40-hp., 2200-volt, 3-phase direct-connected motor. The second unit consists of a 6-in. single-stage, double-suction pump of 1050-g.p.m. capacity, driven at 1700 r.p.m. by a 25-hp., 2200-volt motor. Water drawn from the river by these two units is discharged into the mixing basin, whence it passes successively to the sedimentation basin, sand filter beds and clear-water well.

Two Pumps on One Motor Shaft Operate in Series or Parallel.

The installation for clear-water pumping consists of two units. The first is made up of two 5-in., single-stage, double-suction centrifugal pumps, operated in tandem by a 100-hp., 2200-volt motor. The two pumps, mounted on the same shaft, are arranged for operating either in series or in parallel. When operating in series they deliver about 1200 g.p.m. to the Okanoggan reservoir against a 250-ft. head. When operating in parallel they deliver 2380 g.p.m. to the Douglas street reservoir at 165 ft. head. The second unit of the plant for clear-water pumping comprises a single-stage, 1050-g.p.m. pump direct-connected to a 75-hp., 2200-volt motor, delivering about 1100 g.p.m. under actual test to the Douglas street reservoir at a head of 165 ft.

All equipment is operated from one main control panel equipped with an automatic circuit-breaker and totalizing graphic watt-hour and volt meters. Each pumping unit is controlled from a separate panel equipped with an oil switch, a remote-control automatic starter, over-load relays, and a polyphase watt-hour meter. The electrical and pumping equipment were installed by the Wenatchee Battery & Motor Co., under direction of V. R. Wright, manager.

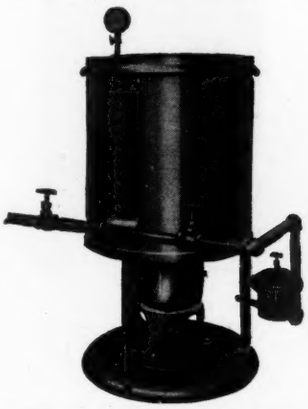
This concern recently installed electric pumping equipment for the town of Cashmere, Wash. This consisted of two DeLaval 5-in. single-stage, double-suction pumps, mounted in tandem, and driven by one Westinghouse 100-hp., 2300-volt, direct-connected motor. The pumps, operating in series, deliver 650 g.p.m. from a well 16 ft. diam. and 32 ft. deep, working against a 380-ft. head. It is planned, however, to increase the size of the mains, reduce the head, and operate the pumps in parallel, giving the plant the capacity to deliver 1300 g.p.m. In all the installations above noted the pumps in actual operation have exceeded their rated efficiency and capacity

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

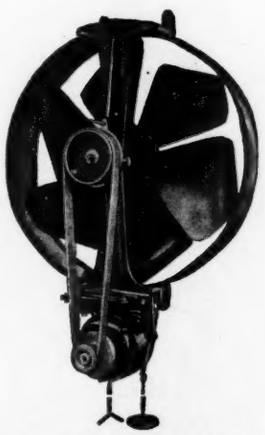
Variable-Speed Fan With Fixed-Speed Motor.

The "Bailey Junior" electric disc fan, supplied by the Bailey Manufacturing Co., Milwaukee, is intended for ventilating laundries, boiler rooms, kitchens,



Bailey Thermo-Unit for Circulating Air Over Steam Coils.

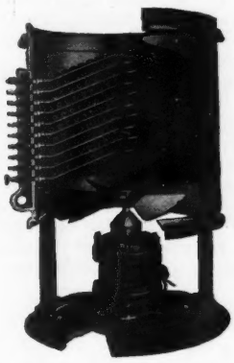
dining rooms, lodge halls, schools, churches, public buildings, theaters, garages, smoke houses, dye rooms, etc., and for removing noxious fumes, blowing fresh air to mines, tunnels and other places where life depends to a great extent on an unfailing supply of fresh air. This fan is unique in that it is equipped with a speed controlling device that permits a variation of from 2.5 to 100% of full speed without any variation of speed of the motor, and with any graduation of speeds between these extremes. This variation is accom-



Bailey Junior Variable-Speed Fan Driven by Constant-Speed Motor.

plished by varying the belt tension by simply turning the hand wheel of the adjusting mechanism to the right, or left, until the desired speed is obtained. An accompanying illustration shows the fan motor with its adjusting bracket, adjusting lever and driving belt. The motor is hinged at one end of its base so that by adjusting the hand wheel the pulley end is moved either towards or away from the fan pulley, thus increasing or decreasing the belt tension and so increasing or decreasing the ratio between the motor and the fan speeds. Aside from the convenience of having control of the speed this arrangement is said to result in economy in energy consumption. In the ordinary direct-connected equipment the motor works at full load all the time or where the motor speed is reduced the extra energy is dissipated in resistance coils.

The "Bailey Junior" is equipped with a standard constant-speed motor of a size and type that can be obtained anywhere at any time, thus eliminating the necessity of putting the fan out of commission while waiting for a new motor in case of accidental damage. The special belt-drive arrangement leaves the motor free to come up to full speed with practically no load. The motor is equipped with a special self-ventilating, self-cooling pulley to prevent burning



Section View Showing Interior of Bailey Thermo-Unit.

the belt while picking up the load. It consists of a cored pulley with a miniature fan cast into it. As the motor speeds up air is taken in at the fan section and passed through the pulley, between the hub and the belt surface, thus preventing excessive heating even under heavy slippage friction. The pulley is provided with a rim to prevent the belt from slipping off while taking on load, and the belt itself is made of grease- and acid-proof material that is guaranteed to last one year or more even under the most severe running conditions. Both pulleys and the belt are fully inclosed with a guard.

Other heating and ventilating devices are shown in accompanying illustrations.

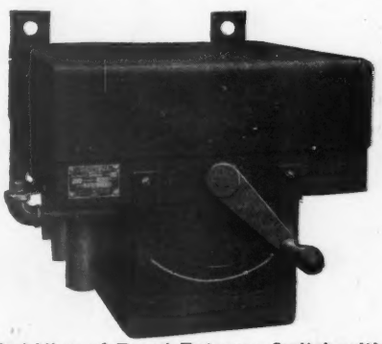
Starting Panels for Use With Slip-Ring Motors.

The General Electric Co., Schenectady, N. Y., has recently brought out a new line of automatic starters for slip-ring motors of any size from 5 to 200 hp., and for all standard voltages and frequencies. These starters are designed for use with push-button, knife-switch, or similar master-switch control, and are for floor or wall mounting depending on the size. The contactors on these panels are of a new and improved type, and are equipped with finger-type interlocks. The primary contactor on the high-voltage equipment has its magnet, coil and interlock mounted outside of the oil in which the contacts are immersed. This arrangement does away with running the low-voltage control circuit inside the oil tank, and also prevents trouble from deposits of carbon from oil heated by the arc. Carbon deposits tend to lessen the insulation resistance between adjacent poles of the high-voltage contactors as well as between the high-voltage lines and the control lines. Since the new type contactor does not have any shaft under oil there is no place for the carbon to deposit, and the possibility of trouble from this cause is eliminated. The panels are designed for full-load starting throughout the whole line, as most application of slip-ring motors call for full load or heavy starting conditions.

Fused Entrance Switch With Safety-First Features.

The Westinghouse Electric & Manufacturing Co. has recently placed on the market a fused entrance switch. This switch is rated at 100 amperes and 2500 volts, and is made in two and three poles single throw. These switches are principally used by distributing companies at the end of their 2500-volt distributing lines, and at the entrance of the line to the customer's plant.

This switch is a maximum in safety-first features. All live parts are completely inclosed in pressed steel case and tank. The leads go in through fiber bushings, and the cover is interlocked

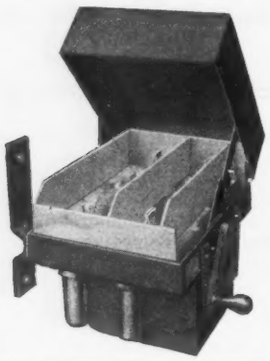


End View of Fused Entrance Switch with Cover Shut.

so that it cannot be opened when the switch is closed. The fuses are entirely cut off from the line when the switch is open.

The switch is primarily an oil immersed knife switch with fuses mounted in the top. The contacts are a spe-

cial self-aligning knife-blade type. The moving contacts are carried on a wooden drum. The fuse clips are also self-aligning and are mounted on a heavy



Side View of Fused Entrance Switch with Cover Raised.

wooden base, and are designed to take standard fuses.

The switch has a large application on high voltage distribution where safety-first features not contained in the ordinary knife switch are desired.

Automatically Controlled Farm Power Plant.

The liberal capacity, the automatic features and the elimination of sources of trouble are points of merit claimed for the 110-volt d-c. automatic power and light plant made by the Kohler Co., Kohler, Wis. This equipment is built for use on the farm, summer resort, the country garage, moving picture theater, construction camp and other places not served with central station energy. This plant has a capacity of 1500 watts, the motive power being provided by a substantial 4-cylinder gasoline engine. With the automatic arrangement provided when any switch on the circuit is turned on the generating unit starts up and continues to operate until the last light or appliance is turned off. The entire action is automatic and eliminates a trip to the plant for starting and stopping. The energy generated, instead of being stored in the usual bank of batteries, feeds directly into the line, and the small starting battery is automatically charged by the generator. The production of 110-volt energy permits the use of a smaller transmission wire and a greater distance of distribution of the power than where low-voltage plants are used. Standard-voltage motors, appliances and lamps can be employed on the circuits supplied by this set.

The generator of this automatic set is driven by a 4-cylinder, valve-in-head gasoline engine operating at 1000 r.p.m. It has a pressure lubrication system, is water-cooled by means of a thermo-syphon system, radiator and fan, and is equipped with a high-tension magneto. The generator is a 4-pole, compound-wound, 110-volt, d-c. machine. The engine, which is governed by mechanical throttling, has a vacuum-tank fuel supply which can be connected to the outside gas tank to save the trouble of constant refilling. The entire unit, installed is 33.5 ins. long, 34.75 ins. high, and 14 ins. wide.

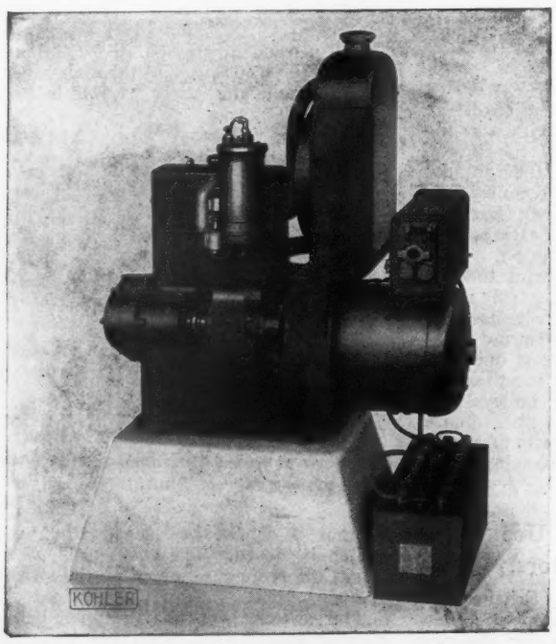
A New Type of Low Pressure Expansion Joint.

A new expansion joint has been placed on the market and it is stated that it has some very remarkable features regarding compressibility and uniform thickness of copper. This joint is known as the "G-R" expansion joint type "C," and is manufactured by the Griscom-Russell Co., 90 West street, New York City. The general construction is shown in the accompanying illustration. The flanges are of castiron and expansion metal of copper. All sizes of this joint have a single corrugation. The most remarkable thing about this expansion joint is the depth of the corrugation which is used, and the fact that the sides of the corrugation are actually parallel for at least 1 in. of their length. These joints are manufactured on a special patented machine and this exclusive patented method of rolling insures a uniform thickness of copper after completion of the joint.

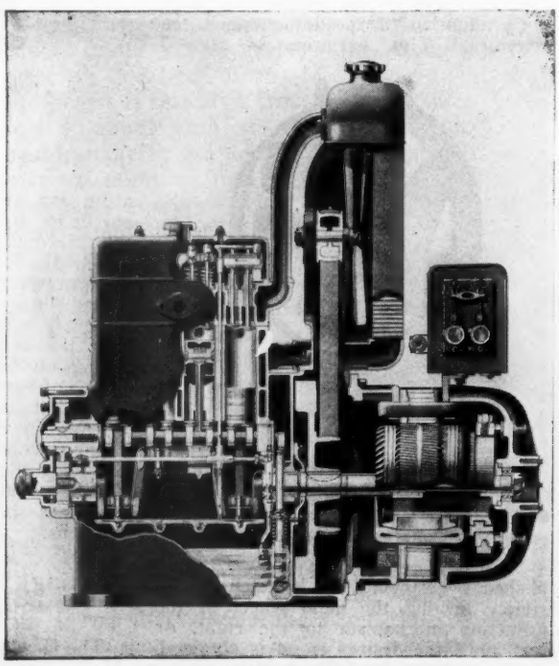
In the manufacture of expansion joints in general, the copper thickness

"G-R" Expansion Joint.

has always been reduced materially by the rolling process, and it is stated this has caused weak spots in the finished joint and has also decreased the flexibility of the joint, because thicker copper sheet had to be used in order to insure that "thinned spots" would not develop. This new patented process which maintains practically unchanged the original copper thickness permits the use of thinner sheet than has previously been used, increases flexibility of the joints and eliminates thinned spots. This is a great step forward in expansion joint design, and is the result of months of experimentation and devel-



Kohler Automatic Generating Set With 4-Cylinder Engine.



Section View Showing Parts of Kohler Automatic Generating Set.

opment by the manufacturer. The manufacturer states that these joints are guaranteed to compress ¼-in. axially when subject to a compressive force of 125 lbs. per in. nominal diam., and to be capable of distortion laterally ⅛ in. with a force of 125 lbs. per in. nominal diam.

These joints are of the low pressure type and are designed particularly for use on steam lines between the turbine and the condenser. The construction and general specifications are fully described in a form sheet No. 176, published by the manufacturer.

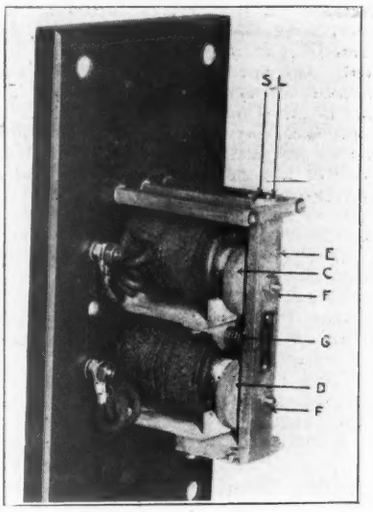
Voltage-Drop Control for D.-C. Motors.

The increasing application of motors to various industries has been greatly furthered and in many cases only made possible by the fact that the design of control apparatus has kept pace with every new condition of service as it arose. One of the chief requirements of a modern automatic control system is dependability, by which is meant continuity of service under the severest conditions. Delays in some industries are so costly that a control whose design saves even fractions of minutes is a highly valuable asset.

With these ends in view the General Electric Co., Schenectady, N. Y., has recently designed a type of control for d-c. motors on either reversing or non-reversing applications which is a combination of time and current limit, allowing high torque where necessary, and still minimizing current peaks on light loads. The system is known as the voltage-drop system, and is so named from the fact that the relays which control the accelerating contactors are operated by the voltage drop across the motor's starting resistor. In reality, since the voltage across the starting resistor is proportional to the current in the resistor, the system is a form of current-limit control. It has been demonstrated that a current-limit system of some sort is best for motors that are subjected to frequent starting and stopping, and that are required to operate under varying conditions of torque. Such conditions include applications where the motor is required at infrequent intervals to accelerate loads as high as twice normal, and should be protected from such high current peaks the rest of the time.

The voltage-drop relay has two independent magnetic circuits—the upper one energized by a calibrating coil, and the lower one energized by an assisting coil as shown in an accompanying illustration. The air-gap adjusting nuts *C* and *D* are fastened to studs which screw into the armature *E*, and are held by the lock nuts *F*. The compression spring *G* holds the relay contacts *S* and *L* normally closed. Both coils of the relay are energized to open the relay contacts, but in actual practice the lower or assisting coil is short-circuited by a contactor. The voltage at which the armature will close the contacts may therefore be adjusted by means of the upper adjusting nut *C*.

A reversing controller consists of a circuit-breaker contactor, reversing contactors, and two accelerating contactors, one of which may be a plugging contactor. The calibrating coils and also the assisting coils of the two relays are connected across the line in series. In the off-position of the master switch with the circuit-breaker contactor closed there is half voltage across each coil of the two relays, causing them to open their contacts. If the master switch is moved to the forward position the forward contactors are energized and close, which short-circuit the assisting coil of the corresponding relay leaving the calibrating coil connected across a resistor section. The two coils of the reversing relay are left energized, assuring that its contacts remain open. The closing of the line contactors allows current to flow in the starting resistor, which gives a voltage across both coils of No. 2 relay, causing it to pick up and to open the circuit to the second accelerating contactor. As the motor accelerates, the voltage drop across the resistor decreases, and at a predetermined value the forward relay releases and energizes the coil of the first accelerating contactor. The first accelerating contactor then closes and short-circuits the calibrating coil of the forward relay, thus this relay cannot open again under operating conditions. The first accelerating contactor also short-circuits the assisting coil of the No. 2 relay, leaving the calibrating coil energized by the voltage drop across the next resistor step. As the motor accelerates the voltage drop across that section of the resistor decreases and the relay closes at a predetermined value, closing the second accelerating contactor.

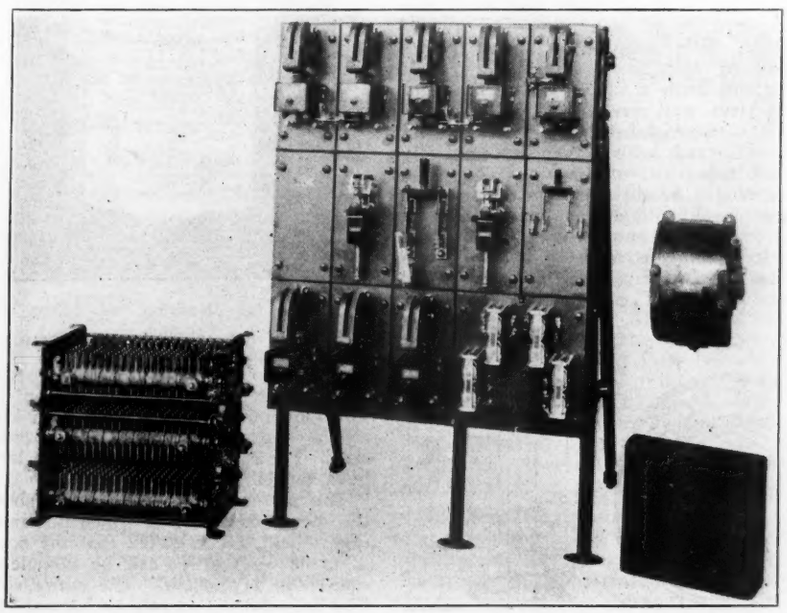


View Showing the Various Parts of a Voltage-Drop Relay.

If the master switch is moved for the reverse direction the same cycle is gone through except that the reverse instead of the forward relay operates, and if a master switch that has speed control points is used the scheme would be similar to the one shown except that one side of the accelerating contactor coils would be wired to the master switch.

The relays possess a small time lag in the releasing of the armature after the assisting coil is short-circuited, caused by the self induction of the coil creating a relatively slow decrease in the magnetic flux. The lag may be varied from approximately 0.05 sec. to 0.3 sec., but it does not affect the calibration of the relay as a whole as fixed by the calibrating-coil adjusting nut. This characteristic allows relays to be set to close the contactors at a relatively high value of current when the motor is heavily overloaded, and still prevent high current peaks when it is accelerated under light loads. The small time lag permits the motor speed to rise enough between the closing of one contactor and that of the next to reduce the peaks for light loads. In fact, when the motor is accelerating under light load the time lag produces an effect equivalent to a lower current-limit setting.

Tests taken to determine the performance of a relay with a current-limit setting of 170% under various load conditions showed that the maximum accelerating peaks, even under very heavy loads (154%) were about 268%, and on light loads (100% and 40%) with the same setting the results were peaks of 220 and 180% respectively. Another interesting feature is that the heating of the starting resistor which changes the resistance of the resistor, and the voltage drop across it, is nearly bal-



Control Panel With Set of Voltage-Drop Relays Mounted on Lower Right Section.

anced by heating of the relay coil due to passage of current.

Aside from the electrical operation this control system has certain other advantages to which the manufacturer calls attention. The control requires only one type of relay and one size of coil for all sizes of motors of the same voltage, making relays including coils interchangeable. Relays may be calibrated, put in stock, and later used with any motor which uses the same number of accelerating contactors, saving much time when replacements become necessary. The system also eliminates practically all electrical interlocks. As for the mechanical features, the relays are entirely separate from the contactors and can be mounted in a group on one corner of the panel and covered to protect them from dirt, fumes, etc., and tampering. Since the contacts never break the circuit they are not subjected to burning, and being vertical there is little chance for dust and dirt to collect on them.

This system, using a new and improved form of shunt contactor, has been applied to standardized panels for the control of various types of motors.

Roller Bearings with Staggered Construction.

From the viewpoint of the plant engineer the subject of bearings is one of vital importance. Therefore he is always interested in new designs, particularly so if he feels that he can increase his plant efficiency.

The Hart Roller Bearing Co., Orange, N. J., is manufacturing a product known as the Hart staggered roller bearing. This bearing is a decided departure from the usual roller bearing in that the roller instead of being one continuous shaft is separated into one or more units and arranged in staggered fashion.

The rolls are made of high-carbon high-chrome steel, hardened and ground, and operate between two raceways of the same material. The rolls are mounted axially on steel cage pins, which in turn are riveted to steel end rings, the pins, rings and rolls constituting the roll assembly which operates between the raceways.

The rolls are drilled out at the center and a suitable running clearance over the cage pin provided. The distance between the end rings is slightly greater than the sum total of the various roll lengths in any combination. This provides for a small axial flotation incident to operation. Rolls and races are ground to very close tolerances. Rigid inspection and manufacturing accuracy insure fulfilment of the close limits specified.

It is the assertion of the manufacturer that roller breakage is minimized in this new style as each roller is short and, should misalignment occur, the rolls adjust themselves to such variations.

The manufacturer states that the load-carrying capacity is more than that of the usual type of roller bearing because the load has a more even distribution and the rolls cannot "creep," thereby causing excessive wear on the cage rings.

Lubrication is of utmost importance to bearings. This fact has been duly considered in the designing of this bearing. The spaces or pockets between rolls of this staggered roller construction serve as oil reservoirs, feeding the lubricant zigzag to the periphery of the rolls, to the space between the rolls and cage pin, and to the faces of the cage rings. Thus the proper lubrication of all parts is secured, the rolls themselves giving the lubricant mass such a motion that it distributes itself adequately to all vital points.

The Hart, therefore, represents progress in the anti-friction journal design. Consequently greater production, lower maintenance and longer life are possible.

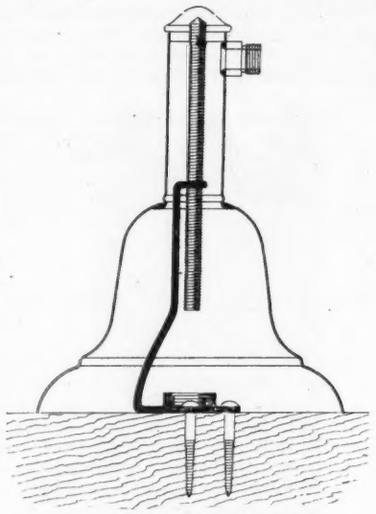
Hart bearings are made in standard S. A. E. sizes and are therefore interchangeable with double-row radial ball and other roller bearings of S. A. E. standard dimensions.

McPhilben Adjustable "One-Piece" Bracket.

An adjustable "one-piece" bracket has recently been placed on the market by the McPhilben Lighting Fixture Co., 264 Fulton street, Jamaica, N. Y., the accompanying illustration showing the way this bracket looks in section when put up on an ordinary stud box. The features of this device are thus set forth by the manufacturer:

The canopy and stem are solidly rolled together and then well soldered, which makes a permanent connection. The open end of the stem is capped with a heavy brass knob tapped to take a threaded bolt-wire connecting it to the support arm. This support arm, which is stated to be an entirely new arrangement, is threaded on the opposite end to fit any standard ⅜-in. pipe thread, therefore fitting ⅜-in. gaspipe, standard fixture studs or outlet boxes. About ¾ in. from the end knob a nipple is fastened into the stem, well riveted and soldered.

The material used in the canopy and stem is much heavier than that generally used in brackets of the "one-piece" type, securing a solidity of construction that does away with denting and breakages in transit and on the job. The support arm is amply strong and is punched to take three wood screws for the knob and tube work. The McPhilben Lighting Fixture Co. states that the bracket has been inspected and approved by the Underwriters Laboratories and the National Board of Fire Underwriters.



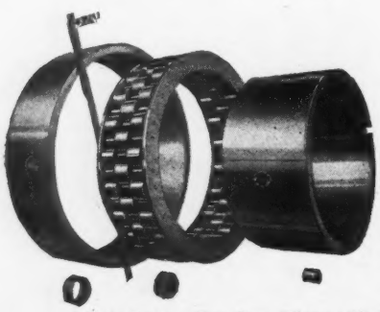
McPhilben Adjustable Bracket.

Dressing for Serious Burns and Scalds.

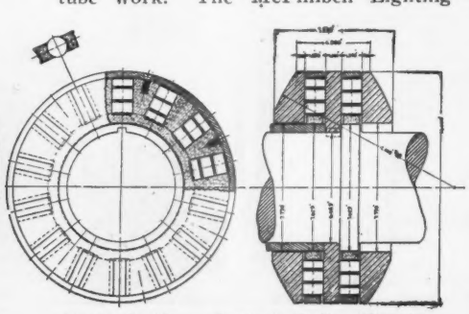
A first-aid dressing for serious burns and scalds has recently been placed on the market by the Industrial Products Co., 1001 Chestnut street, Philadelphia. This consists of a solution of bicarbonate of soda and minerol. A tint of color is added to show liquid. Three separate rolls of gauze are immersed in this solution and are provided with a knot at the ends so as to make extraction easy. The entire affected part of a large burn can be quickly covered.

Container for Dressing for Burns and Scalds.

The accompanying illustration shows the special container in which the dressing is held. It is stated that the cover is made so that it can be completely opened in a moment. The entire solution does not deteriorate or become rancid, and can be kept indefinitely.



Hart Roller Bearing Dismantled.



Cross-Section of Hart Roller Bearing.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Louis Adams and J. P. Hetherington, Huntington, W. Va., plan to establish a plant for electric and acetylene welding.

Pendell Boiler Co., Schenectady, N. Y., has filed notice of increase in its capital stock from $100,000 to $200,000 for general expansion.

Western Union Telegraph Co., New York City, has disposed of a bond issue of $15,000,000, the proceeds to be used for extensions and improvements in its system, general operations, etc.

New Departure Manufacturing Co., manufacturer of ball bearings, etc., has moved its Chicago sales office from 2721 South Michigan avenue to the Peoples Gas building, 122 South Michigan avenue.

Porcelain Insulator Corp., Lima, N. Y., manufacturer of porcelain insulators and transmission line accessories, has issued bulletins Nos. 1 and 2, illustrating and describing its line of "Pinco" insulators.

American Steel & Wire Co., 208 South LaSalle street, Chicago, has announced the appointment of H. S. Durant as sales agent, and M. W. Floto as assistant sales agent at its Detroit office, to succeed M. Whaling and T. J. Usher, Jr., resigned.

Illinois Refrigerator Co., Morrison, Ill., began operations in its mill room Aug. 15 after a 6-mo. shutdown. It is announced that the wage scale has been cut from 15 to 40%. Other departments, employing about 200 men normally, will be reopened soon.

Delta Star Electric Co., 2433 Fulton street, Chicago, manufacturer of high-tension equipment, has opened a district office at 294 Washington street, Boston. This office is in charge of Messrs. Anderson and Van Rosen, who have for several years been connected with the Delta Star engineering department at Chicago.

Standard Underground Cable Co., Washington street, Perth Amboy, N. J., has made application to the Board of Aldermen for permission to extend the railway lines at its plant, preliminary to the erection of a number of extensions, for which plans are now being prepared. The enlargement will comprise about 100,000 sq. ft. of additional floor space, and is estimated to cost $250,000. C. C. Baldwin is vice-president.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued a reprint of leaflet 1610-C covering the operation, construction and safety features of type "A" auto-starters. This leaflet describes in detail the auto-transformers, switching mechanism, the contacts, the overload relays, and many other features of this apparatus. Storage battery mine locomotives is the subject of leaflet 1888-A, which has just been printed by the company. This leaflet describes the applications of storage battery mine locomotives and illustrates and treats on the Baldwin-Westinghouse type of apparatus.

Hurley Machine Co., Chicago, manufacturer of the "Thor" electric washing machines, ironing machines, vacuum cleaners, etc., at a meeting of the board of directors Aug. 22 increased the number of vice-presidents from three to five, Edward N. Hurley, Jr., and James A. McCoy being elected to the two vacancies created. John Proudfoot, assistant treasurer, was elected treasurer to fill the vacancy created by the promotion of Mr. McCoy.

Mitchell-Rand Manufacturing Co., 20 Vesey street, New York City, manufacturer of insulating materials for more than 32 yrs., is about to launch an extensive campaign to introduce "Shield Brand" soldering paste to the trade. To all hardware and electrical jobbers and dealers located in the eastern and middle western states of the United States a generous sample of the paste, contained in a 1-oz. attractive tin box will be sent upon application and the opportunity given for them to test out the product to their own satisfaction.

Westinghouse Electric International Co. has announced that an order has been received from the Imperial Government of Japan for two 62-ton freight electric locomotives, these locomotives to operate around Tokio. They are the standard box type, 42-in. gage, and are to operate on 1200 to 1500 volts d.c., with overhead line equipment, multiple unit control, containing four motors of 250 hp. each. These locomotives will be built at the East Pittsburgh works by the Westinghouse Electric & Manufacturing Co., the work to begin at once, and to be completed in 1 yr.

Radio Corp. of America, Woolworth building, New York City, has preliminary plans under way for the construction of a wireless plant at Warsaw, Poland, in accordance with a contract closed with the government of that country. The station will comprise 10 steel towers, each 400 ft. high, and aerial lines about 2 mi. long. It is estimbated to cost $3,000 000. The company is planning the early operation of its new plant at Port Jefferson, L. I., consisting of a number of 400 ft. steel towers, now nearing completion. This plant is to be known as "Radio Central," and will be one of the most powerful stations in the world.

Northern Engineering Works, Detroit, has published a 4-page illustrated circular in which its type E cranes are described and illustrated. Some of the features of these cranes are: Entirely enclosed gears; cast steel gears; forged steel pinions; transmission type of gearing; two-bearing shafts; shafts do not extend across trolley; hoisting gear train from armature to drum is in one cast frame; no overhung gears and specially constructed foot-walk; double brakes on hoist; quick acting foot-brake on bridge; structural girt between trolley frames; positive type direct-acting automatic hook-limit stop and motors and controllers of standard makes.

Rogers, Brown & Co., with offices in New York City, Chicago, Boston, Buffalo, Philadelphia, Pittsburgh, St. Louis, Cleveland and Cincinnati, have been appointed sole agents in the United States for the sale of virgin aluminum of various grades produced by the Norsk Aluminum Co., Christiania, Norway. Stocks of aluminum will be carried in New York City and Cleveland.

Osgood Bradley Car Co., Worcester, Mass., has received an order for 22 electric zone cars from the New York, New Haven & Hartford Railroad Co. The order includes 14 trailers and eight motor-equipped cars. The cars will be used on the New York division between New York City and New Haven. The cars will be built complete in Worcester and electrical equipment for them will be furnished by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Pawling & Harnischfeger Co., Milwaukee, has issued pamphlet TX which describes and illustrates the new skimmer boom design for attachment to the standard P & H 205 or 206 excavator-crane. The point is made that by replacing the standard boom of either of these cranes an efficient road grading machine is provided. In fact, this is similar to the shovel attachment brought out earlier this year and which is designed for use with either of the two types of P & H cranes mentioned. Data and operating costs figures on the road grading job done by William Datka, contractor, are included, together with a profile for the road prepared by the county highway department.

Klaxon Co., Newark, N. J., has announced the appointment of the following sales agents to handle the distribution of its code-calling system, industrial signals, horns, bells and relays: Metropolitan district, P. M. Farmer, 30 Church street, New York City; Philadelphia district, E. Luman Mills, Philadelphia Bourse, Philadelphia; Boston district, Henry A. Howard, 146 Summer street, Boston; St. Louis district, Kingsland-Rawlings, Inc., 375 Arcade building, St. Louis; Chicago district, Palmer & Knowles, 189 North Clark street, Chicago, and New Orleans district, Pendleton E. Lehde, 609 Whitney Central building, New Orleans, La. Additional sales agents will shortly be appointed at Pittsburgh, Cleveland, San Francisco and Detroit.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

A. H. SWEETNAM, who for the past 4 yrs. has been connected with Stone & Webster, Inc., Boston, in the capacity of electrical engineer, has resigned to accept the position of assistant superintendent of the electrical engineering depart-

A. H. Sweetnam.

ment, The Edison Electric Illuminating Co. of Boston. Mr. Sweetnam was born in 1880 in Ligonier, Ind., where he received his early education. After service in the Spanish-American war, he was employed in the construction department of the Commonwealth Edison Co. and the Detroit Electrical Co., leaving the latter to enter Purdue University from which he was graduated in the course of electrical engineering in 1905. During the following 2.5 yrs. he was connected with Sargent & Lundy, designing engineers, resigning to become electrical engineer of the Cosmopolitan Electric Co., Chicago, which position he held until the company was taken over by the Commonwealth Edison Co. in 1913. From this time until 1917 he was attached to the engineering department of the Commonwealth Edison Co., having supervision of installation and repairs of Edison, railway and 60-cycle substations. During the past 4 yrs. he has had charge of design of electrical installations in power and substations and industrial properties, as well as report work, devoting considerable time to properties under the management of Stone & Webster, Inc. Mr. Sweetnam is a member of the American Institute of Electrical Engineers, National Electric Light Association, Boston City, Engineers, and Woodland Golf Clubs.

E. E. SANFORD, manager of the securities department of the Northern States Power Co., St. Paul, recently addressed the St. Paul Rotary Club on the subject of "The Development of the Northern States Power Co. and Its Relation to the Communities Served."

DWIGHT T. FARNUM has been elected a member and vice-president of the industrial engineering firm of C. E. Knoeppel & Co., Inc., 52 Vanderbilt avenue, New York City.

RALPH C. SCHWARZ, 921 Granite building, Rochester, N. Y., has taken over the northwestern New York territory for the distribution and sale of Stewart industrial furnaces and appliances.

OBITUARY.

ROBERT TEN EYCK LOZIER, long associated with Thomas A. Edison in the development of electric light, power and railway industries, and in recent years employed in the consulting capacity by large financial interests, died in the Post Graduate Hospital, New York City, of pneumonia, Sunday, Aug. 21. Mr. Lozier was born at South Norwalk, Conn., May 5, 1868, and when 14 yrs. old became assistant statistician of the Edison Electric Light Co. As a protégé of Thomas A. Edison he was closely associated with the great inventor in much of the experimental and development work carried on at the Edison Machine Works in Goreck street, New York City, and later at the Llewellyn Park laboratory. He was the first electrical engineer for the Sprague Electric Co. and continued in that position for 13 yrs., finally becoming assistant to the general manager of the lighting department and manager of the isolated lighting department. For 8 yrs. he served as general manager of sales for Bullock Electric Mfg. Co.

Mr. Lozier was closely associated with Frank J. Sprague, pioneer of electric railway development, and made the first design for the drum-type of railway controller. In 1888 he assisted in building and testing the first multipolar (annular frame) generator at Mr. Edison's laboratory, and later was one of the pioneers in the introduction and use of individual motors for machine drive as well as in the development and application of the so-called "Teazer" system for operating large newspaper printing presses. Personally he directed the installation of these equipments in the principal newspaper offices of the United States. Mr. Lozier was a member of the Engineers Club, Railway Club, secretary of the Edison Pioneers, fellow of the American Institute of Electrical Engineers and a life member and past president of the New York Electrical Society.

A. H. WINSLOW, manager, Appropriations Department, National Lamp Works of General Electric Co., was killed in an automobile accident near Malinta, O., Friday night, Aug. 26, when the car skidded over an embankment pinning the five members of the party beneath it. Mrs. Winslow, who was a member of the party, sustained serious injuries. Mr. Winslow was born at Marblehead, Mass., Nov. 17, 1863, and had been engaged in the lamp business throughout the greater part of his business career. He was first associated with the Thompson-Houston Co., which later became the General Electric Co. He was head accountant of Lynn Works, General Electric Co., from August, 1892 until July, 1893 when he was made paymaster, which position he held until April, 1894. At that time he was made disbursement clerk for the General Electric Co. with offices in Schenectady. He served in that capacity until July, 1903 when he was made general auditor of the National Lamp Works, Cleveland. In 1914 he became manager of the newly created appropriations department of the National Lamp Works, holding that title until his untimely death.

Mr. Winslow was active in civic and community life. He was a member of the East Cleveland Civic League and the East Cleveland Chamber of Commerce. He also held membership in the Cleveland City Club, Cleveland Athletic Association, Ohio Athletic Association, Electrical League of Cleveland, and Cleveland Automobile Club. He was a member of many Masonic bodies including Windermere Blue Lodge, Windermere Chapter, Oriental Commandery, Windermere Council, Lake Erie Consistory, Al Sirat Grotto and Al Kron Shrine.

JOHN M. SMITH, sales manager of the Ivanhoe-Regent Works of General Electric Co., Cleveland, dropped dead recently in the store of Wm. E. Gray Co., electrical contractors, 64 Genesee street, Utica, N. Y., due to an attack of heart disease. Mr. Smith was on his annual visit to customers of the company and, accompanied by his wife and

John M. Smith.

H. E. Reddick, one of his salesmen, arrived in Utica the night before, having motored from Albany. Mr. Smith was 52 yrs. of age and, besides his widow, is survived by a son, Robert. At his home in Cleveland, where the body was taken for burial, he was a member of the Masonic fraternity and had a wide circle of social and business friends.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Dover, N. H.—Electrical equipment will be installed in the plant addition to be erected by Prosper Shevenell & Sons, 44 Maple street, manufacturers of shoes, 45 by 130 ft., estimated to cost $25,000.

Bridgeport, Conn.—The Heppenstahl Forge Co., Harvard avenue, has completed plans for the erection of a pumping plant at its works.

Hartford, Conn.—Hartford Electric Light Co. is planning the early installation of machinery and equipment at its plant, now in course of construction at Colt Meadows, to be a 4-story building, 155 by 206 ft. Construction work is nearing completion. Stone & Webster, Inc., 147 Milk street, Boston, has the erection contract.

New Haven, Conn. — Considerable electrical machinery and equipment, including motors, controlling apparatus, etc., will be installed in the plant addition to be erected by the National Folding Box & Paper Co., James street, estimated to cost $150,000.

New Haven, Conn. — New Haven Real Estate & Power Corp. has filed notice of dissolution under state laws.

Forestdale, R. I.—Forestdale Mfg. Co. has awarded a contract to the Eastern Construction Co., Woonsocket, R. I., for the erection of a 1-story power plant at its textile mills, about 30 by 60 ft.

Providence, R. I. — Considerable electrical equipment will be installed in the plant to be erected by the Williams & Anderson Co., 33 Broad street, on property recently acquired on Highland avenue and North Main street, to be used for the manufacture of emblems and other metal products. Monks & Johnson, Boston, are architects.

Albany, N. Y.—The State Superintendent of Public Buildings, Capitol building, is having plans prepared for the installation of additional electrical equipment on the fourth floor of the Capitol building. Lewis F. Pilcher is State Architect.

Brooklyn, N. Y.—Queens Borough Gas & Electric Co., 347 Central avenue, Far Rockaway, L. I., has been granted permission by the Public Service Commission to issue capital stock to an amount of $2,229,000, the proceeds to be used in part for extensions, improvements, and general operations.

Corinth, N. Y.—The Corinth Electric Light & Power Co. has been granted a permit to erect a plant here.

New Rochelle, N. Y.—Considerable electrical equipment will be installed in the 2-story plant to be erected by the Willert Instrument Co., 13 Rose street, on Huguenot street, to be 70 by 250 ft., and estimated to cost $60,000.

New York, N. Y.—The Interborough Rapid Transit Co., 165 Broadway, is considering the installation of an electric alarm system to protect employes from robberies.

New York, N. Y.—Machinery and stock of the Knickerbocker Chandelier & Electric Supply Co., 325 West 42nd street, were damaged recently by fire.

New York, N. Y.—New York Edison Co. will furnish light and power service at the new 10-story building of the Heckscher Foundation for children on Fifth avenue, near 104th street. Plans for the installation have been perfected.

New York, N. Y.—New York Steam Corp. has been organized to take over and operate the property of the New York Steam Co., which has been operating under a receivership for some time past. The Public Service Commission has granted permission to the new organization to issue $400,000 in mortgages on real estate, and $2,300,000 in general mortgage bonds, for betterments, general operations, etc. James D. Hurd is president.

Syracuse, N. Y.—Considerable electrical equipment will be installed in the ice plant to be constructed by the People's Ice Co., 1001 North State street. Plans are being completed.

Utica, N. Y.—The Board of Directors, Utica State Hospital, Marcy Division, will soon take bids for the construction of a 2-story cold storage building at the institution, estimated to cost $65,000, with electrical and other equipment.

Atlantic City, N. J.—The Board of Public Utility Commissioners has granted permission to the Atlantic City Electric Co. to issue stock to an amount of $144,100, the proceeds to be used for proposed extensions, betterments, general operations, etc.

Camden, N. J.—Electrical equipment will be installed in the plant to be erected by the Wilson Motor Co. on Haddon avenue, estimated to cost $40,000.

Chester, N. J.—Central New Jersey Power Co. is arranging for the development of property at Lake Takeene, near Chester, to include the installation of electric lines for light and power service.

Elizabeth, N. J.—Frank A. English, receiver for the B. & B. Electric Co., 278 Morris avenue, has arranged a sale of the property of the company.

Kearny, N. J.—The Board of Education, Kearny avenue, will take bids up to 8:15 p. m., Sept. 16, for electrical work, heating and ventilating work, and kindred installations at the high school to be erected on Devon street. Boilers will be of low pressure, tubular type. Intake and exhaust fans will be motor-driven. Guilbert & Betelle, 546 Broad street, Newark, N. J., are architects. Edmund Stevenson is secretary of the Board.

Newark, N. J.—George C. Bergen, Essex county purchasing agent, Board of Freeholders, is arranging the installation of a ground lighting system at the Essex Mountain sanatorium, Verona, N. J. Runyon & Carey, 845 Broad street, are engineers.

Newark, N. J.—The Department of Public Safety, City Hall, Director Brennan in charge, is considering the installation of a new electrically operated police signal system.

Pompton Lakes, N. J.—The Borough Council has directed the Water and Light Department to arrange for additional water supply to double the capacity of the municipal electric power plant.

Trenton, N. J.—The Board of Freeholders has arranged an ordinance regulating the installation of proposed new underground conduit lines by the Delaware & Atlantic Telephone & Telegraph Co., Camden, N. J. New overhead lines will also be built by the company.

Farnshurst, Del.—The Board of Directors, Delaware State Hospital, has perfected plans for the erection of a 1-story powerhouse at the institution.

Allentown, Pa.—The Shamokin, Eldred, Cameron, Ralpho and Zerbe Electric companies have been incorporated under state laws, each with a nominal capital of $5000, to install and operate electric systems in Northumberland county. The same interests control all companies, being headed by C. M. Walter, J. S. Wise, Jr., and L. K. Bingaman, Allentown.

Brownsville, Pa.—In connection with the rebuilding of the plant of the Brownsville Window Glass Co., to replace the works recently destroyed by fire, with loss of about $300,000, considerable electrical equipment wil be installed, including motors, controlling devices, etc. W. S. Phillips is general manager.

Butler, Pa.—The People's Telephone Co. has received permission from the Public Service Commission to acquire the Fenelton Telephone Co., and the Burton Telephone Co., operating in this district, and merge the properties with its system.

Carlisle, Pa.—The system of the Valley Railways Co., extending from Newville to Carlisle, by way of Plainfield, will be abandoned and the equipment removed. Work on demolishing the line has been commenced.

Catasauqua, Pa.—Directors of the Catasauqua Park and Playground Association are planning the installation of an ornamental street-lighting system on the western side of Catasauqua

creek, extending the full length of the property. Steel standards will be used with 10-in. globes provided with 100-watt lamps.

Harrisburg, Pa.—The City Commission has arranged a bond issue of $800,000 or extensions to the filter plant at the municipal waterworks, and additions to the system. Considerable electrical and mechanical equipment will be required. Bids for the work will be asked in the near future. Commissioner S. F. Hassler is in charge.

Lancaster, Pa.—Pioneer Electric Light Co., operating in Lancaster county, has advanced its minimum monthly charge for lighting service from $1.38 to $3.

Milton, Pa.—Electrical machinery and equipment will be installed in the local milk and dairy plant to be erected by the Dairymen's Co-operative Association, Mann building, Utica, N. Y., located on Race street and estimated to cost $200,000.

Philadelphia, Pa.—Four large electrically operated pumping plants at the works of the Atlantic Refining Co., Passyunk avenue, were destroyed by fire, Aug. 15, spreading to other portions of the works, with total loss estimated at $1,000,000, including equipment.

Philadelphia, Pa.—The Board of Works has awarded a contract to the Standard Underground Cable Co., North American building, for electric wire and cable for municipal service.

Philadelphia, Pa.—Electric Power & Equipment Co., Commonwealth building, has received a contract for motors, switchboard, meters, pumps and other equipment for the new pumping station for the municipal waterworks at Gloucester, N. J., at a cost of $39,301.80.

Philadelphia, Pa.—The Philadelphia Rapid Transit Co. will install considerable electrical and mechanical equipment at its car repair shop to be erected at 31st and Dauphin streets. It is estimated to cost $50,000.

Philadelphia, Pa.—Considerable electrical equipment will be installed in the addition to be erected at the plant of the Brighton Worsted Co., Tioga and D streets, estimated to cost $60,000.

Philadelphia, Pa.—The additional power plants needed for operation of the Frankford Elevated Railway should be built by the city and not by the Philadelphia Rapid Transit was a conclusion reached at the third of a series of conferences in the mayor's office with a view of drafting a satisfactory form of agreement for leasing the city-owned Frankford Elevated Railway and Bustleton surface line to the Rapid Transit Co.

Pittsburgh, Pa.—Considerable electrical, mechanical and refrigerating equipment will be installed in the 7-story plant to be constructed by the North Pole Ice Co., 1218 West Carson street, estimated to cost $400,000.

Pittsburgh, Pa.—Electric motors, mechanical fans, ventilating and heating apparatus, etc., will be installed in the three public school buildings now contemplated for early erection by the Board of Education. The structures with equipment are estimated to cost $1,500,000.

Pittsburgh, Pa.—Considerable electrical equipment will be installed in the food product factory to be erected by the Kingham Provision Co., at 112 Pennsylvania avenue, estimated to cost $100,000. S. F. Heckert, Bessemer building, is architect in charge.

Pleasant Grove, Pa.—York Haven Water & Power Co., York Haven, Pa., will commence the construction of a line to Pleasant Grove at once, for local power and light service.

Reading, Pa.—The Pennsylvania Edison Co. has disposed of a bond issue of $125,000, the proceeds to be used for extensions, general operations, etc. The company has arranged to furnish service for a new signal tower at Phillipsburg, Pa., to be constructed by the Central Railroad of New Jersey.

Saylorsburg, Pa.—The Saylorsburg Light & Power Co. has been formed under state laws with a nominal capital of $20,000 to operate an electric light and power system in this district. Frank D. Shupp, Saylorsburg, is treasurer.

Sunbury, Pa.—Electrical and mechanical equipment will be installed in the 2-story baking plant, 70 by 130 ft., to be erected by the Butter Krust Baking Co., 249 Eckman street, estimated to cost $140,000. W. H. Leeds, 32 South 16th street, Philadelphia, is architect.

Baltimore, Md.—The United States Engineers Office is completing surveys of the Susquehanna river, from Harrisburg, Pa., to Port Deposit, Md., ordered by Congress, for the proposed establishment of a number of hydroelectric generating plants and navigation development. The present plans call for the construction of five dams for impounding waters for electric power service, and five generating stations. The work, including electric transmission and distributing lines, is estimated to cost $100,000,000. Major Harrington, Baltimore, United States Engineer's Office, is in charge.

Baltimore, Md.—Terminal Freezing & Heating Co. has made application to the Public Service Commission for permission to issue notes for $85,000, for extensions, general operations, etc.

Oxford, Md.—The Board of Commissioners is arranging a bond issue of $18,000 to defray in part the cost of the erection of the proposed municipal electric power plant.

Washington, D. C.—The local Chamber of Commerce is at the head of a movement to effect a merger of the Potomac Power Co., Washington Railway & Electric Co., and the Capitol Traction Co.; the consolidation is urged in the interests of public benefit, with a single utility controlling light, power and traction service.

Parksville, Va.—Roanoke River Development Co. is perfecting plans for the erection of its proposed hydroelectric generating plant at Buggs Island, near Clarksville, to comprise two units of 50,000 and 10,000 hp. capacity, respectively. A dam will be constructed across the Roanoke river. Headquarters of the company are at Roanoke, Va.

Winchester, Va.—The question of establishing municipal lighting is under consideration. Address the mayor.

Yorktown, Va.—The Bureau of Yards & Docks, Navy Department, Washington, D. C., is perfecting plans for the erection of a power house at the local property of the Department.

Logan, W. Va.—Kentucky & West Virginia Power Co., 30 Church street, New York City, has plans under way for the erection of an addition to its hydroelectric generating plant on Little island, Guyandotte river, vicinity of Logan, to cost $1,000,000. The work will include the installation of two new 15,000-kw. turbo-generator units and auxiliary operating equipment. Francis R. Weller, Hibbs building, Washington, D. C., is consulting engineer for the project.

Morgantown, W. Va. — Rosedale Coal Co. is planning the installation of electric motors and other electrical equipment at its coal properties in Monongalia county.

Charlotte, N. C.—Southern Power Co. is planning the construction of an addition to its hydroelectric power plant in the vicinity of Great Falls, S. C.

Greenville, N. C.—E. E. Williams, superintendent of the Light and Water Commission, will install a lighting system. Address city clerk.

Hickory, N. C.—Hickory Power Co., recently organized with a capital of $2,000,000, is arranging the establishment of a new hydroelectric generating plant in this section.

Lenoir, N. C.—Caldwell Power Co., recently organized with a capital of $300,000, is planning the construction of a hydroelectric generating plant, with distributing system in this district. The company is headed by J. H. Beall and J. L. Nelson.

Lenoir, N. C.—Granite Falls Mfg. Co. is planning the construction of a hydroelectric generating plant on Wilson creek, for its textile mill operation in this section.

Columbia, S. C.—Columbia Railway & Navigation Co. has received permission from the Federal Power Commission, Washington, D. C., to construct a hydroelectric power plant on the canal to be built connecting the Cooper and Santee rivers. The initial plant will have a capacity of about 30,000 hp. A high-tension system will be constructed from Columbia to Greenwood, S. C. The project is estimated to cost $5,000,000. G. A. Guignard is president.

Springfield, Ga. — The Common Council is considering the installation of a street lighting system in certain sections of the city.

Gulfport, Fla.—The Common Council, Gulfport, is planning the installation of a new electric street lighting system. A transmission system will also be constructed. S. J. Webb is city clerk.

Long Branch, Fla.—Brooks Tomato Products Co., St. Louis, Mo., is planning the installation of a power house at its plant at Long Branch.

Merritt, Fla.—Merritt Island Light & Power Co. contemplates establishing an electric plant to furnish light

and heat. Address O. R. Grosse, president.

Russellville, Fla.—The Common Council is planning the installation of a street lighting system in the business section.

NORTH CENTRAL STATES.

Akron, O.—Northern Ohio Traction & Light Co. has perfected arrangements with the city council for the installation of a trackless trolley line.

Ashtabula, O.—M. H. Turner, city manager, has taken bids for the purchase of bonds to an amount of $400,000, the proceeds to be used for the erection of an addition to the municipal electric power plant. The entire project is estimated to cost $1,000,000, and other bonds will be voted later. Stone & Webster, 147 Milk street, Boston, are engineers.

Cincinnati, O.—Considerable electrical and mechanical equipment will be installed in the proposed cold storage plant to be established by the Central Cold Storage & Warehouse Co. A building has been acquired on Elm, near Henry street, and this will be remodeled and equipped at a cost of about $200,000.

East Liverpool, O.—Improvements costing about $37,000 are to be made to the holdings of the Ohio Power Co. in the East Liverpool district. Plans are being laid for rebuilding the high-tension line from the Wellsville substation to Boring's Crossing, entailing a cost of about $10,000. This is a 13,000-volt line. The line from Boring's Crossing to Empire will also be repaired at a cost of $7000. Address H. G. Sterling, manager.

SOUTH CENTRAL STATES.

Newport, Tenn.—W. A. Nelson, Box 271, and associates, are planning the erection of a local ice manufacturing plant.

New Orleans, La.—In a report covering the local light, power and traction system of the New Orleans Railway & Light Co., Frederick W. Ballard, Cleveland, O., lighting expert employed by the city, recommends an immediate appropriation of $545,000 for extensions and improvements in the electric light and power branch of the business to provide for the proper operation and estimated demand during the coming winter. The report sets forth that within the next 5 yrs. an amount of $23,240,000 will be required for extensions and replacements for adequate operation.

Shreveport, La. — Elliott Electric Co. is planning the replacement of its plant, heretofore located in the Lane building, Spring street, recently damaged by fire.

Russellville, Ark. — An electric lighting system will be installed in the business section. Address the mayor.

Ketchum, Okla.—A project to throw a dam across Grand river near Ketchum in Mayes county is being revived. The promotors are Byron Kirkpatrick and Charles Page, of Tulsa, and W. B. Collins of Ketchum. These men and others compose a corporation capitalized at $20,000,000 and their charter has been granted. The corporation has sold bonds to the amount of $16,000,000 to a New York firm.

WESTERN STATES.

Hoquiam, Wash.—A resolution providing for the installation of a boulevard lighting system on both sides of Eighth and First streets has been passed. Address city clerk.

Seattle, Wash.—The city council has appropriated $25,000 to strengthen existing power lines of the city. Bids were received Aug. 26 by William D. Freeman, purchasing agent, for furnishing two 7500 kv-a., 54,000-volt transformers, according to specification on file in room 231, City Hall building.

Tacoma, Wash.—The city council passed an ordinance providing for a system of street lighting on South Eighth, Ninth and Tenth streets. Address city clerk.

Portland, Ore.—W. L. Benham, 1212 Gasco building, has filed an application for developing power from Clear, Lava, Fish and Lost lakes and McKenzie river for general commercial purposes. A canal or pipe line 5 mi. long will be constructed.

Richmond, Cal.—Final plans for the electroliers on the business streets of Richmond are before Manager George N. Rooker, of the Western States Gas & Electric Co., and they will soon be erected.

St. Catharines, Ont.—Recent estimates show that the Chippewa-Queenston hydroelectric power canal, now in course of construction under the direction of the Ontario Hydro-electric Commission, will cost about $75,000,000 to bring to completion. Initial estimates for the work approximated $50,000,000.

Toronto, Ont., Can.—The English Electric Co. has taken over a controlling interest in the Canadian Crocker-Wheeler Co., Ltd., and will continue the operation of the company in connection with its own electrical manufacturing business.

INCORPORATIONS.

Jamaica, L. I., N. Y.—Bangert Electric Co. Capital, $40,000. To manufacture electrical equipment. Incorporators: W. A. and A. M. Vangert, and T. Breiling.

New York, N. Y.—Markoe & Wallace Electrical Co. Capital, $5,000. To manufacture and deal in electrical equipment. Incorporators: R. Markoe, J. W. Wallace and F. J. Ashley. The company is represented by A. Males, 366 Broadway.

New York, N. Y.—Beacon Lighting Fixture Co. Capital, $10,000. To manufacture electrical fixtures and other kindred equipment. Incorporators: L. E. McMahon, E. A. Reilly and M. Ravitch. The company is represented by O'Brien, Malevinsky & Driscoll, 1482 Broadway.

New York, N. Y.—Croton Development Co. Nominal capital, $5,000. To manufacture electric power machinery. Incorporators: A. M. Barbe, H. R. McKenzie and E. M. Davidson.

Philadelphia, Pa.—Bush Hill Electric & Supply Co. Capital, $50,000. To manufacture electrical fixtures and supplies. Incorporators: Walter M. Fixter, Walter F. Secules and Robert B. Yohey.

Williamsport, Pa.—Bloom-Harper Co. Capital, $15,000. To manufacture electrical supplies. A. N. Bloom, Williamsport, is treasurer.

Philadelphia, Pa.—Schimmel Electric Supply Co. Capital, $330,000. To manufacture and deal in electrical supplies. L. D. Schimmel, 318 Market street, is treasurer.

Pittsburgh, Pa.—Standard Electric & Radio Corp. Being organized by David Rose, T. H. Lewis and Clarence O. Fisher, to manufacture electrical and wireless apparatus. Application for a state charter will be made shortly. Ben P. Brasley, Bakewell building, represents the company.

Baltimore, Md.—Piedmont Electric Co., 204 North Gay street. Capital, $10,000. To operate a general electrical contracting business. Incorporators: Stephen N. Buchanan, Paul E. Giese and George A. Harrison.

New Albany, Ind.—Shrader Battery Co. Capital, $20,000. To manufacture electric storage batteries and kindred products. Incorporators: Daniel Shrader, W. A. Shrader and Julius Maier.

Pittsfield, Mass.—Mountain Electrical Supplies Co. Capital, $50,000. To manufacture electrical supplies. George H. French, president; and William A. Whittlesey, treasurer.

Springfield, Mass.—Arrow Light Co. Capital, $30,000. To manufacture electrically operated signal devices. Gordon W. Gordon, president; and Adam W. Jentoch, vice-president.

Rochester, N. Y.—Strongheart Battery Plate Manufacturing Co. Capital, $15,000. To manufacture electric storage batteries. Incorporators: B. R. Sherman, H. Leshner and F. Wiedman, E. & B. building, Rochester.

Lawrence, N. Y.—E. L. Westervelt, Inc. Capital, $50,000. To manufacture electric motors and other electrical products. Incorporators: E. W. Trombly, W. Schneider and L. H. Hall.

New York, N. Y.—Morton Electrical Supply Co. Capital, $10,000. To manufacture and deal in electrical supplies. Incorporators: E. R. May, T. Hansen and J. O. Humphrey. The company is represented by Hansen & Dreeben, 50 Broad street.

New York, N. Y.—United Lamp Manufacturers' Corp. Capital, $75,000. To manufacture electric lamps, etc. Incorporators: H. Wolff, R. Press and S. Math. The company is represented by E. Hollander, 8 Bline avenue, Union, N. J.

Newark, N. J.—Clinton Electric Co., 266 Springfield avenue, has filed notice of organization to manufacture motor parts and operate a motor repair works. Edward Snyder heads the company.

Camden, N. J.—Witte Sales Co. Capital, $100,000. To manufacture electrical appliances. Incorporators: Stephen M. Paschall, John E. Fennell and Edmund A. Witte, 214 Broadway.

Allentown, Pa.—Barry Electric Co. Capital, $5,000. To manufacture and deal in electrical equipment. C. M. Walter, Allentown, is treasurer.

Champaign, Ill.—H. C. White Electric Co., 119 South Neil street. Capital, $20,000. To manufacture and deal in electrical apparatus. Incorporators: M. E., H. C. and K. B. White.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Offering of Wisconsin Utility Company's First Mortgage Bonds.

An issue of $1,500,000 Wisconsin Traction, Light, Heat & Power Co. 5% first mortgage bonds, dated July 1, 1901, and due July 1, 1931, paying 7.5%, is being offered by Rutter, Lindsay & Co., Chicago and Milwaukee, and the First Wisconsin Co., of Milwaukee, at a price of 98 and interest, to yield approximately 7.80%.

The Wisconsin Traction, Light, Heat & Power Co. operates without competition the electric light, power, gas and street-railway business in the cities of Appleton, Neenah and Menasha, Wis., and also does an extensive electric light and power business in the Fox River Valley district. Electric power is generated in a hydroelectric plant with a modern steam auxiliary equipment, located on the Fox river at Appleton, from which it is distributed by transmission lines to all the light and power properties. In connection with these properties the company owns and operates an electric interurban railway from Neenah through Menasha and Appleton to Kaukauna, forming the central link in a continuous interurban system connecting Fond du Lac on the south with Green Bay on the north.

It is reported that the gross earnings show steady increases in each of the last 10 yrs., indicating the stability of the company's earnings power and the substantial character of the territory served. Of the gross earnings for 1920, 59% was derived from the electric business, 21% from the gas business, and 20% from the railway business. For the last 10 yrs. the average net earnings have been equal to more than 2.25 times the average interest charge. The company has been recently granted increased rates for all departments of its service. During the months of June and July, 1921, the net earnings applicable to the payment of interest charges on bonds outstanding and to be issued were in excess of 2.5 times the interest requirements, although such increases were in effect only in part during this period.

Bankers Purchase Havana Power Bond Issue.

The Havana Electric Railway, Light & Power Co. has announced that it has sold to its bankers, Speyer & Co., New York City, $1,500,000 5-yr. 7% secured gold notes dated Sept. 1, 1921. The notes are secured by $3,000,000 of the company's general mortgage 5% bonds.

Bond Issue of Kentucky Utility Sold to Bankers.

The Lexington Utilities Co., Lexington, Ky., has sold an issue of $560,000 first lien and refunding, series B, 6% bonds to Chandler & Co., Inc., of New York City and Philadelphia, and R. E. Wilsey & Co. of Chicago, which will be offered shortly.

Telephone Company Granted Permission to Issue Additional Stock.

The Illinois Bell Telephone Co. has been granted permission by the Illinois Commerce Commission to issue $10,000,000 additional capital stock. Ninety-eight per cent of the new stock goes to the American Telephone & Telegraph Co., the parent concern, while the other 2% is offered to present stockholders. The entire shareholders' portion of $200,000 has already been taken, it is reported.

Baltimore Utility's Preferred Stock Offered to Public.

Spencer, Track & Co., Chicago, and Chase & Co., Boston, are offering an issue of $2,500,000 Consolidated Gas, Electric Light & Power Co. of Baltimore 8% cumulative preferred stock, series "A," at a price of 100 and accrued interest. The Consolidated company does the entire gas, electric light and power business in the city of Baltimore, including the supply of all power used by the street railways. Its operations also extend into the suburbs and surrounding counties, serving a population of about 775,000.

It is reported that the surplus available for dividends and depreciation in the 10.5 yrs. ended June 30, 1921, averaged $1,905,421 per annum, a sum equal to over 76% on the present issue of $2,500,000 8% cumulative preferred stock series "A," or over 9.5 times the annual dividend requirements of the issue. In the 2.5 yrs. ended June 30, 1921, this surplus averaged over 12.5 times the annual dividend requirements of this issue of preferred stock.

Detroit Edison Co.

For July	1921.	1920.
Total gross revenue	$1,671,161	$1,674,117
Net earnings	348,990	168,783
Surplus after deductions	62,611	*40,436
For 7 mo. ended July 31—		
Total gross revenue	$13,295,561	$11,993,119
Net earnings	3,414,789	2,311,677
Surplus after deductions	1,482,631	1,025,514

*Deficit.

Northern States Power Co.

Operating results of the Northern States Power Co. for the 12 mo. ended June 30, 1921, are reported as follows:

Gross earnings	$12,818,189
Operating expenses	8,025,406
Net earnings	4,792,783
Fixed charges	2,242,889
Balance	2,549,894
Preferred stock dividend	1,465,529
Surplus available for depreciation, amortization, common stock dividends, etc.	1,084,365

Cities Service Co.

Year ended July 31—		July.
Gross earnings	$18,503,064	$698,672
Net earnings	17,878,378	656,018
Balance after interest	15,857,934	464,092
Surplus after preferred dividend	11,043,645	60,706

American Water Works and Electric Co.

The consolidated income account for the year ended June 30 last shows: Gross operating earnings of $5,357,426, net earnings $1,978,988, gross income $2,628,762, net income after total deductions $516,268.

Utah Power & Light Co.

Combined statement of Utah Power & Light Co., the Western Colorado Power Co. and Utah Light & Traction Co. for the year ended Dec. 31, 1920, shows surplus after charges, taxes and depreciation of $974,489, as compared with $1,012,152 in the previous year. Combined statement for the year ended Dec. 31, 1920, compares as follows:

	1920.	1919.
Gross earnings	$8,591,206	$7,330,952
Net after taxes	4,086,694	3,771,039
Other income	129,086	94,707
Total income	4,215,780	3,865,746
Interest, etc.	2,481,566	2,453,594
Depreciation	759,725	400,000
Balance	974,489	1,012,152
Preferred dividends	591,500	575,456
Common dividends	345,590	345,590
Surplus	37,399	91,106

American Public Utilities Co.

The American Public Utilities Co. reports net earnings from operations of $2,142,302 for fiscal year ended June 30, 1921. This compares with $1,868,675 for preceding year.

Dividends.

	Term.	Rate.	Payable.
Am. Pr. & Lt., com.	Q	1%	Sept. 1
Black. V. G. & E., com.	Q	$1	Sept. 1
General Electric	Q	2%	Oct. 15
G. City E. L. & P., com.	Q	2%	Aug. 29
G. City E. L. & P., pfd.	Q	2%	Sept. 1
Key West El., pfd.	Q	$1.50	Sept. 1
Midland Securities	Q	$2.50	Sept. 30
Montana Pr., com.	O	$0.75	Oct. 1
Montana Pr., pfd.	O	$1.75	Oct. 1
Nor. Texas El., com.	O	$2	Sept. 1
Nor. Texas El., pfd.	SA	$3	Sept. 1
Penn Water & Pr.	Q	1.75%	Oct. 1

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Aug. 22	Bid Aug. 29
Adirondack Electric Power of Glenns Falls, common	6	9½	9¼
Adirondack Electric Power of Glenns Falls, preferred	6	69	69½
American Gas & Electric of New York, common	..	103	104
American Gas & Electric of New York, preferred	6	37	37½
American Light & Traction of New York, common	..	92½	93½
American Light & Traction of New York, preferred	6	79	78
American Power & Light of New York, common	4	57	55½
American Power & Light of New York, preferred	6	63	66
American Public Utilities of Grand Rapids, common	..	7	7
American Public Utilities of Grand Rapids, preferred	..	105⅞	105½
American Telephone & Telegraph of New York	7	17	17
American Water Works & Elec. of New York, common	..	4	3½
American Water Works & Elec. of New York, particip	7	8	7½
American Water Works & Elec. of New York, 1st preferred	..	48	46
Appalachian Power, common	..	5	4
Appalachian Power, preferred	7	28	30
Cities Service of New York, common	+extra	114	112
Cities Service of New York, preferred	6	44	44
Commonwealth Edison of Chicago	8	108½	109
Comm. Power, Railway & Light of Jackson, common	..	10	10½
Comm. Power, Railway & Light of Jackson, preferred	6	29½	28½
Federal Light & Traction of New York, common	..	7	6½
Federal Light & Traction of New York, preferred	..	42½	42
Northern States Power of Chicago, common	..	36	36
Northern States Power of Chicago, preferred	ex.div.7	79	79
Pacific Gas & Electric of San Francisco, common	..	54	55
Public Service of Northern Illinois, Chicago, common	7	79⅞	80
Public Service of Northern Illinois, Chicago, preferred	6	80	80
Standard Gas & Electric of Chicago, common	..	8	8½
Standard Gas & Electric of Chicago, preferred	8	34	34½
Tennessee Railway, Light & Power of Chattanooga, common	..	1	¾
Tennessee Railway, Light & Power of Chattanooga, preferred	6	4	3½
Western Power of San Francisco, common	..	26	25½
Western Union Telegraph of New York	..	83½	81⅝
Industrials—			
General Electric of Schenectady	8	121⅛	111¼
Westinghouse Electric & Mfg. of Pittsburgh, common	7	43½	40